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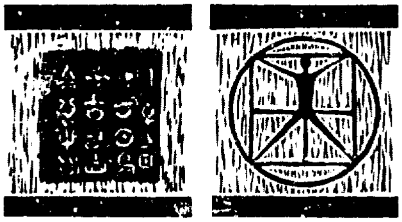
FINAL REPORT
DOD USER-NEEDS STUDY, PHASE II

FLOW OF SCIENTIFIC AND TECHNICAL INFORMATION WITHIN THE DEFENSE INDUSTRY

VOLUME II
A. TECHNICAL DESCRIPTION
B. TECHNICAL APPENDICES



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North American Aviation, Inc. Autonetics Division

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DOD USER-NEEDS STUDY, PHASE II

FLOW OF SCIENTIFIC AND TECHNICAL INFORMATION WITHIN THE DEFENSE INDUSTRY

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A. TECHNICAL DESCRIPTION
B. TECHNICAL APPENDICES

30 NOVEMBER 1966

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Office of the Director of Defense Research and Engineering
Advanced Research Projects Agency
Department of Defense
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1. INTRODUCTION

1.1 PURPOSE AND OBJECTIVES OF PHASE II

The principal technical tasks of Department of Defense (DOD) contractors are research, development and production of weapons and their supporting systems. Their efforts involve searching for and using an enormous amount of scientific and technical information. This store of information is continually growing, accompanied by an increasing need for improving the process of acquiring it.

The problem in the design of information systems is to channel the required information to interested persons as efficiently as possible. The goal is to provide the right information to the right person, in the right form, at the right time. A first step in achieving this goal is to define the user's need and procedures for acquiring technical information.

The Office of the Director of Defense Research and Engineering has initiated a two-phase study of user needs to determine the information acquisition patterns within the defense community. A prior study (DOD User-Needs Study, Phase I) surveyed these patterns among a random sample of research, development, test and evaluation (RDT&E) personnel of the Department of Defense.

The aim of the present Phase II study is to perform a similar survey to learn how scientists and engineers in the defense industry gather scientific and technical information. Data were obtained by personal interviews with a representative sample of 1500 from a population of approximately 120,000 scientists, engineers and technical personnel. These personnel were employed by 73 companies, 8 research institutes and 2 universities that are defense contractors. Each interview dealt with a specific task recently completed by the user, and his experiences relating to the need for, search for, and acquisition of information required in performing the task. Data were also collected concerning the individual's use of formal technical information centers and services, and on his background, experience and work activity.

The major study objectives were to answer questions in the following areas:

- What are the educational, experience and job characteristics of the users of scientific and technical information in the defense industry?
- What is the nature of the scientific and technical tasks within the defense industry?
- What characteristics does the defense industry exhibit in its utilization of technical information centers and services?
- What characterizes the search and acquisition process in the defense industry?
- What are the significant factors within the flow of scientific and technical information (flow process) for the defense industry?
- What are the differences between DOD in-house and defense industry personnel and their needs and procedures for acquiring scientific and technical information?

The study concentrated on the information wanted and used to perform specific tasks. It was not concerned with "current-awareness" (i.e., "intentional browsing" that is not task-oriented) information which a person uses to maintain an awareness of the state of the art, to educate himself, to review previously known areas, and to stimulate his thinking.

Many investigations have been performed, and much has been written, concerning the flow of scientific and technical information. The tendency, however, has been to examine only small portions of the flow process, or to speculate about large portions of the flow process in vague generalities. Therefore, very little of a comprehensive, definitive and unifying nature actually has been said about the process. The DOD User-Needs Study is the first attempt to obtain data on a large portion of the flow process, and the Phase II analysis is the first attempt to draw definitive and unifying conclusions from these data. This, in turn, will provide the first comprehensive definition of the information requirements in today's complex array of scientific and technical endeavors.

1.2 CONCLUSIONS

The major conclusions of the study can be expressed in the form of guidelines for management decisions bearing on the direction and scope of DOD information programs. These guidelines are supported by the numerical results which appear in Sections 5, 6, and 7, and in Volume III. The two surveys produced a considerable mass of data concerning the scientific and technical process and its information needs. It is likely that additional analysis in depth may yield further information about the user's needs and the flow process that would permit refinements and additions to the present guidelines.

Importance of Certain Categories of Information

Priority of effort should be assigned to information which is:

- In the development phase of the research, development and production cycle.
- Related to design and performance.
- In the engineering field.

The engineering subfields that are of greatest interest are electronics and electrical engineering, and aeronautics and space technology.

Importance of the Local Work Environment as a Source for Information[1]

Eighty percent of the time, the Phase II users first searched for information within the local work environment. Therefore, information policies should recognize and seek to strengthen the utility of local sources of scientific and technical information. Specifically, more effort should be devoted to:

- Organized storage and active circulation to the local work environment of information which is informal or semiformal in composition.

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[1] The "local work environment" extends only as far from the user as an internal company consultant, but not as far as the company Technical Information Center, which is his connection with the formal information system (see Table 1-2).

- Tailoring for the local work environment the indexing, abstracting, organization and analysis of information, prior to its distribution.

- Selective and automatic dissemination to the local work environment of these tailored indexes, abstracts, and organized and analyzed information.

Partially organized and analyzed ("once-over-lightly") information is of questionable value, since it satisfies only a small percentage of information needs in task-oriented situations.

Publicity Concerning DOD Information Centers and Services

More effort should be devoted to publicity programs for informing the scientific and technical community, especially within the defense industry, regarding the availability of DOD Information Centers and Services and the procedures for their most efficient use.

Satisfying the Needs of the Significant Users of Information

More effort should be devoted to satisfying the needs, and minimizing the information acquisition problems, of the significant users of scientific and technical information. In general, these users are characterized by their value to the company: that is, they are research and development scientists or engineers who have an advanced degree, are specialists or in lower management levels, and are highly paid. These personnel are also the real users of information centers and services and the ones most frustrated by problems involving their use.

Input/Output Relations for the Flow Process

The major components of the flow process are the (a) USER of scientific and technical information, (b) scientific or technical TASK, (c) UTILIZATION of information centers and services, and (d) SEARCH AND ACQUISITION process. From a systems design point of view, it is both informative and suggestive to consider (see Figure 1-1):

- The primary "input/output" relation (symbolized by arrow 1) with USER and TASK as "inputs" (i.e., tending to influence) and UTILIZATION and SEARCH AND ACQUISITION as "outputs" (i.e., tending to be influenced).

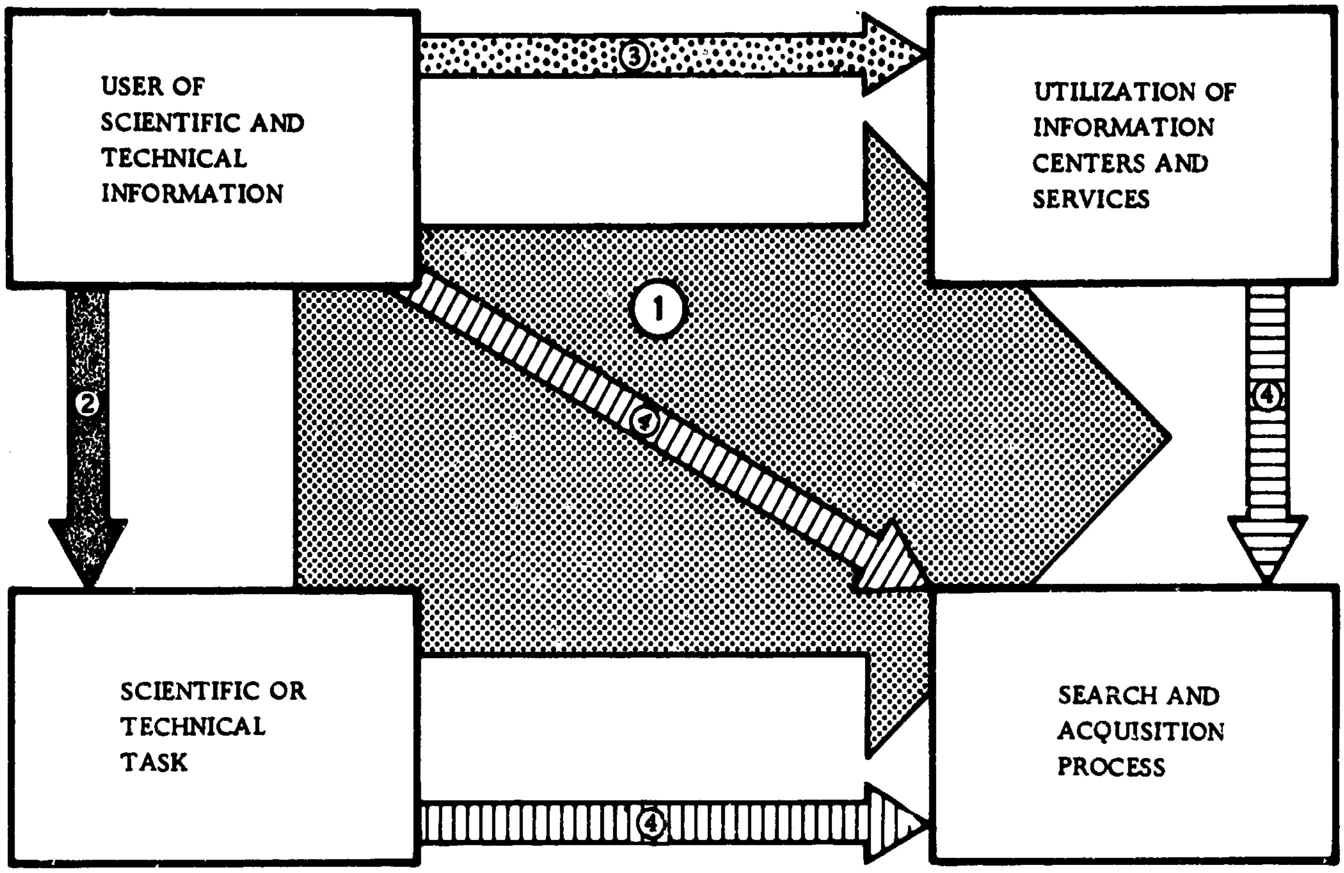
- A secondary input/output relation (symbolized by arrow 2) with USER as input and TASK as output.

- A secondary input/output relation (symbolized by arrow 3) with USER as input and UTILIZATION as output.

- A secondary input/output relation (symbolized by the arrows marked 4) with USER, TASK and UTILIZATION as inputs and SEARCH AND ACQUISITION as output.

Significant Relationships within the Flow Process

The analysis characterized relationships among elements of the flow process. These relationships should be utilized in the planning and operation of scientific and technical information programs. Among the more significant relationships are:



*The arrows point from input (tending to influence) to output (tending to be influenced).

Figure 1-1. Input/Output Relations for the Flow Process*

- The higher the user's level and value to his organization, the more complex the task and its information requirements.
- Greater complexity of the task occurs earlier in the research, development and production cycle. In the earlier phases of the cycle, information is needed in greater formality and detail; and it takes longer to acquire this information.
- As the formality of the task output increases (i.e., from findings through decisions to plans), the complexity of the information tends to increase.
- When more time is available for a task and for the acquisition of information, the user tends to be more demanding in regard to the organization of the media conveying the information and the volume of information required.
- Those who tend to make more use of information centers and services, want more formality and detail in the information media to satisfy their needs.
- When the user goes to a more distant first source (i.e., formal information centers) the information requested will involve more formal media, in greater volume and accompanied by a greater allowable acquisition time. On the other hand the more distant first source tends to yield only part of the needed information, so that further search is required.

Comparison of Phases I and II

The five general conclusions of Phase I are:

- Engineering data is the most important category of information.
- The local work environment is the most important first source for information.
- Information analysis prior to distribution is important in a scientific and technical information program.
- The DOD Information Centers and Services are not sufficiently used.
- The user is not completely satisfied with his ability to obtain information.

Although answers to comparable questions in Phases I and II exhibit significant differences (see Section 7), the Phase II data sustain these conclusions.

Continuing Study and Analysis

More effort should be devoted to the extension of progress made by the DOD User-Needs Study, as described in the following subsection.

1.3 RECOMMENDATIONS[2]

The two surveys of user needs within the Government and defense industry environments have yielded a wealth of valuable data relating to the scientific and technical information flow process. The analysis of these data, notwithstanding cost and schedule limitations inherent in an exploratory research project, has resulted in useful but preliminary insights into and explanations of the flow process. However, there are abundant lodes of information yet to be discovered, mined and refined, in order to exploit more fully the economic value of the available data base.

The Phase II study was a pioneering attempt to draw comprehensive, definitive and unifying conclusions from data on a large portion of the flow process. From the perspective gained in this study, it is clear that certain portions of the flow process merit further investigation and that there is considerable room for refinement and extension of the analysis. A more detailed discussion of the recommendations contained here may be found in Section 8.

The present study has provided a valuable basis for this further investigation and refinement. In addition to yielding guidelines for management decisions, it has also provided:

- A structure and its numerical description with which to view, construct and estimate models describing the information flow process.
- A framework for designing field experiments, performing estimation and testing hypotheses concerning the flow process.

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[2] Since the discovery and exploitation of the desired information is subject to the law of diminishing returns, the recommendations are goals and should be assigned priorities according to the twin criteria of objectives and available resources.

- A methodology for overcoming the analytic deficiencies in past and present user-needs studies[3] by the relationship analysis cycle of transforming qualitative question responses into numerical form, constructing and estimating multivariate models for relationships within the flow process, and then transforming the numerical relationship results back to qualitative form.

- A basis for the recommendations which follow concerning: (a) additional field experimentation regarding the flow process; (b) a program for coordinating additional field experimentation and computer simulation in the analysis and optimization of the flow process[4]; and (c) refined analysis of the data from the Phase I and Phase II studies.

Additional Field Experimentation

In order that the implications of Phase II be fully exploited, the flow process merits further investigation. There should be additional field observation, experimentation and analysis regarding the flow process, such as:

- An investigation of the feasibility and effect upon the flow process of the guidelines in Section 1.2.

- An investigation of task-oriented use of information centers and services.

- Experiments, suggested in Reference 3, concerning (a) dissemination of documents; (b) dissemination of scientific and technical intelligence information (i.e., what is going on); (c) organization and analysis of information in selected fields; (d) indexes, title listings, abstracts and catalogues in selected fields; (e) Specialized Technical Information Centers; (f) techniques for processing information; and (g) evaluation and improvement of technical writing.

- Experiments suggested in Reference 7, which appeared while this final report was in publication.

- Specific experiments suggested by refined analysis of the data.

A Program for Analysis and Optimization

The flow of scientific and technical information has a profound, but as yet uncharacterized, effect upon the performance of scientific and technical tasks. In their efforts to improve task performance, both DOD and its contractors have made large investments in information centers and services. Optimization of the flow process will produce substantial benefits in terms of quality, resources and time.

The flow process and its effect upon task performance are quite complex, and field experimentation regarding them is both difficult and expensive. For such

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[3] Noted by H. Menzel in Chapter 3 of Reference 2, and by B. Griffith and W. Paisley during the Progress Review Panel on Information Needs and Uses at the 29th Annual Meeting of the American Documentation Institute, October 3-7, 1966.

[4] The flow process is optimized when its effect upon the performance of a scientific or technical task is optimized.

processes, mathematical solution is usually not feasible and computer simulation is often an effective and efficient means to complement field experimentation.

When the model (mathematical representation) for the process is translated into a simulation computer program (computer representation) for the process, the process and the effects of various factors upon it may be simulated. The accuracy and precision of the computer simulation increase as the accuracy and precision of the model increase. Therefore, computer simulation yields appropriate results at any stage of one's knowledge about a process, ranging from relative ignorance to relative certainty.

There are four periods in the evolution of a body of knowledge, as it matures from an art into a science: description, modeling, prediction, and control and optimization. With the completion of Phase II, knowledge concerning the flow process is emerging from the description period and entering into the modeling period.

Specific recommendations for additional experimentation have already been given. We now briefly describe a general program to coordinate field experimentation and computer simulation in the analysis and optimization of the flow process. This program (see Figure 1-2) is an improvement of one which was developed by North American Aviation, Inc., and is currently being utilized by a Government Agency on a process of comparable complexity. A more complete treatment of the program may be found in Section 8.

The program, which is adaptive in nature, is composed of ten basic stages:

1. Quantitative process analysis to transform the elements of the process into numerical form; and to construct a process model, with unspecified constants, for relationships among component parts of the process.
2. Experimental trial(s) to yield experimental data.
3. Process model estimation to produce estimates of unspecified constants in the model from experimental data and available auxiliary data.
4. Simulation programming to construct a simulation computer program from the model.
5. Simulation trial(s) to yield simulation data.
6. Process model and simulation data comparison to provide a validation (i.e., positive check) for the simulation computer program.
7. Experimental and simulation data comparison to provide a validation for the combination of process model and simulation computer program.
8. Experimental and simulation data analysis to aid optimization by suggesting improvement of the process.
9. Process optimization to iteratively improve the process and apply appropriate stages of the program to the improved process.
10. Design of experimental and simulation trials to implement process optimization.

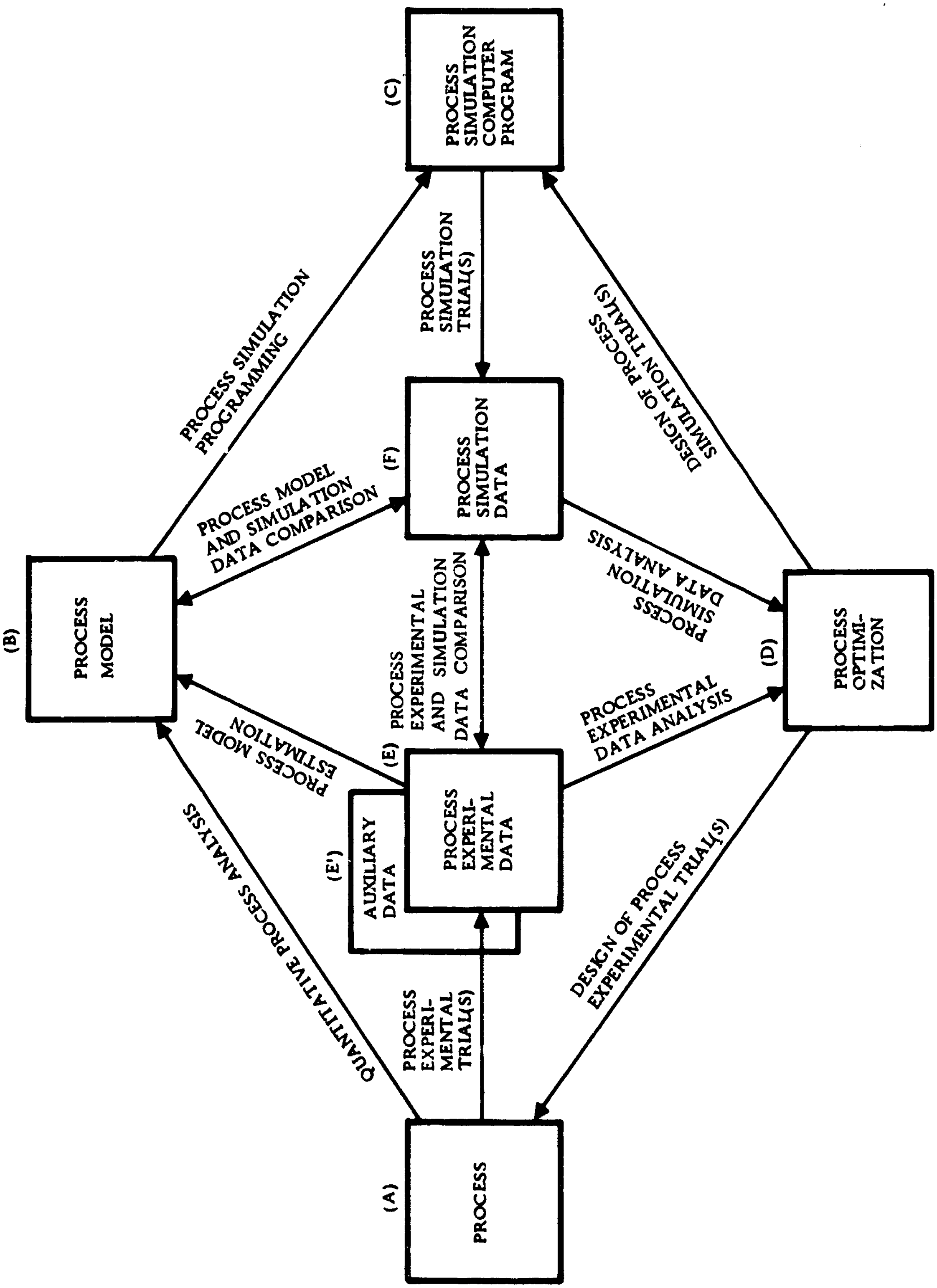

Figure 1-2. Program for Analysis and Optimization

Additional experimentation is covered by Stages 1 through 3. Stages 4 through 7 concern computer simulation and its validation. In Stages 8 through 10, analysis and optimization of the flow process are treated.

The recommendations stated here provide the basis and framework for a long-term investigation and improvement of the flow process.

Refined Analysis of the Data

Since only a small fraction of the effort expended in collecting data is typically devoted to its analysis, a large amount of the information it contains generally is undiscovered and unexploited.

A more profound understanding of the DOD/defense industry information flow process can be achieved through more refined analysis of the data, as suggested below:

- More thorough examination of the distribution of answers to questions, and relationships among questions.
- Investigation into the effect of company size, industry, and interviewer bias on the answers to questions.
- Improvement in the arrangement of responses to a question, and the association of a numerical value with each response to a question, with the objective of improving the linearity of relationships among questions.
- Incorporation into the analysis of differences between the corresponding characteristics of the desired and actually received information, and additional special indices.
- Reformulation and re-estimation of appropriate models for relationships among questions, in order to reflect the above improvements and to investigate more specific relationships which involve only single questions (rather than combinations of related questions).
- For purposes such as the study of the selective dissemination process, formulation of reverse models to study the flow process in reverse (i.e., reverse the input/output relations described in Sections 1.2 and 6.) An example would be a model relating the user's highest degree to the class of information, desired composition and layout of the information media, the first source for the information, and the usefulness of title listings or abstracts.
- Formulation and estimation of additional models describing the flow process, and utilization of additional analytical techniques (such as factor analysis).
- Division of the sample of 1500 users into appropriate subsamples to permit analysis and comparison of special groups, such as the three groups which acquired information that is: (a) conceptual, (b) design and performance, and (c) production.

- Application, as appropriate, of the above suggestions in making further analyses of the Phase I data, the similarities and differences of the Phase I and Phase II data, and the combined data from Phase I and Phase II.

1.4 METHODOLOGY

The methodology employed in the study of the defense industry (Phase II) was based on precedents established in the prior Phase I study of DOD personnel engaged in RDT&E. Improvements in methodology were achieved by profiting from lessons learned in the Phase I study, and through the use of a more comprehensive and powerful analytical approach. Also, the Interview Guide used in Phase I was tailored and improved to make it more suitable for use in a survey of defense industry needs. A more complete discussion of the methodology appears in Sections 2, 3, and 4 and Appendix 15.

Interview Guide

The initial portion of the study required (a) modification of the Interview Guide, (b) preparation of an Interview Guide Handbook and Reference Manual for use by the interviewers, (c) testing of the modified Interview Guide to validate revisions and provide a basis for further improvements, and (d) selection and training of the interviewers.

Modification of Interview Guide

The Phase I Interview Guide had to be modified in two major areas: (a) tailoring to the defense industry population; and (b) overall improvement based on Phase I experience, North American Aviation technical evaluation, and the pilot test. Modifications were designed to:

- Reorganize it, by removing extensive tables and including them in a separate Interview Reference Manual.
- Improve the printing and layout, making it easier to record data during interviews.
- Provide increased logical order of questions.
- Minimize the number of questions (e.g., by letting one group of related questions cover an entire subject, when possible).
- Assess the utilization of company Technical Information Centers.
- Assess the utilization of Non-DOD Specialized Information Centers.
- Investigate restrictions on availability of technical information.
- Provide for mutually exclusive responses.
- Expand, reorient and rearrange question responses.

The revised Interview Guide contained 63 questions, grouped according to (a) the user of information, (b) his most recent scientific or technical task, (c) his utilization of information centers and services, and (d) his search for and acquisition of information specifically related to the task. Most of the responses to questions in the Interview Guide are qualitative and, therefore, not susceptible to quantitative interpretation without using special techniques.

Interview Guide Handbook and Interview Reference Manual

The Interview Guide Handbook (Reference 4) is the basic documentation for the initial portion of the Phase II study. It contains an explanation of and instruction in the interviewing methods, questions to be covered and aids for the interviewers. In developing this Handbook, the primary theme was to tailor it to serve both as a training document on the objectives and conduct of the study and as an interviewer reference. The Handbook also contains the basic study correspondence, a directory of participating organizations and a glossary of terms.

An innovation in Phase II was the introduction of an Interview Reference Manual. This Manual contains a compact, easily-handled listing of frequently used and complex responses for questions in the Interview Guide. The document was basically an interviewer aid, and was shown to the respondent when it would facilitate the interview. Instructions in the use of the Interview Reference Manual are contained in the Interview Guide Handbook.

Pilot Test

A modified Interview Guide was pilot tested to validate the revisions accomplished for the Phase II study. As specified by DOD, the pilot testing was based on 20 interviews with selected engineering and scientific personnel of North American Aviation, Inc. The pilot test resulted in a reorganization of the questions into a more logical sequence.

Survey Operations and Controls

Selection and Training of Interviewers

Interviewers were selected on the basis of their scientific and technical backgrounds, research experience, interviewing and survey experience, maturity, personality and responsibility. All interviewers had at least a bachelor's degree and prior interviewing experience. The interviewing staff employed in the Phase II survey included eight behavioral scientists, three operations research analysts and three information processing specialists.

Each interviewer was given a two-week training program, consisting of classroom instruction and controlled field practice interviews. Training emphasized standardization of survey interview techniques in dealing with a highly diversified sample. Training sessions included Program Orientation, Scientific and Technical Information Systems, Survey Operations, Review of Phase I Results, Comprehensive Study of the Interview Guide, Summary of the Analysis Plan, Interview Demonstration, and four days of practice interviews with critiques of student performance. Remedial sessions were scheduled when the need for them was indicated during the practice interviews.

Selection of Sample for the Interviews

The National Security Industrial Association and the Director of Technical Information in the Office of the Director of Defense Research and Engineering contacted and obtained voluntary participation of the majority of organizations cooperating in the survey. North American Aviation, Inc. helped arrange for the participation of additional qualifying organizations. The organizations surveyed included 14 of the top 25 DOD contractors and 17 of the top 25 RDT&E contractors. They are considered representative of the major DOD/RDT&E contractors. Appendix 1 lists participating organizations with the sample sizes drawn for each.

The Director of Technical Information provided explicit instructions on the method to be employed by the participating organizations in selecting the samples of individuals for interview. The sample for interview was obtained by the selection of a representative group of 1500 from a population of approximately 120,000 scientists, engineers and technical personnel. These personnel were employed by 73 companies, 8 research institutes and 2 universities having defense contracts. In addition, the sequential acquisition of data permitted strong positive checks to be made upon the internal consistency and representative nature of the sample. The individuals sampled represent approximately 1.5 percent of the total scientific, engineering and technical personnel of the 83 participating organizations.

Pre-Survey Preparation of the Interviewees

Early in the planning of survey operations, it was determined that the conduct of the survey and the quality of responses would be enhanced considerably if interviewees were familiar with the purpose of the study and the kinds of questions to be asked. Consequently a descriptive brochure, Synopsis of Interview Topics (see Appendix 8), was developed and distributed to each interviewee in advance of the interview.

This brochure acquainted the interviewees with the topics to be discussed. It provided a frame of reference, introduced the general subject matter of the interview, and tended to ease possible confusion and apprehension. The Synopsis also reassured the interviewee's management that the survey was solely intended to investigate information needs and acquisition procedures, and that it was not an attempt to obtain classified or proprietary information. Comment from the interview staff indicated that the Synopsis fulfilled its intended purposes.

Interview Policy

The sample to be interviewed spanned a diversity of backgrounds (e.g., field of training and extent of formal education) and position levels (e.g., type of activity and level of responsibility). In addition, the flow of scientific and technical information is not widely discussed or understood. It was, therefore, realized that the interview questions might have different meanings to different interviewees.

In order to achieve comparable results under these conditions, the interview was "standardized" so that essentially the same information would be collected from each interviewee. This was achieved by the interviewer tailoring the formulation and sequence of the questions to each interviewee (i.e., "non-scheduled" interviewing). The interview was predominantly one of "free response," (i.e., where an explanation or description was required) in which there were few explicit bounds upon interviewee

responses. An interviewer also encouraged interviewees to talk freely of their experiences, and to give examples of their information search and acquisition patterns.

Operations

Early in the study program it was recognized that successful results would require careful planning, scheduling and control of survey operations. It was also clear that data collected in the field had to be monitored for quality, so that conclusions based on the data would be valid and meaningful.

Survey operations included correspondence with participating companies, interview scheduling, aggressive follow-up of missed interviews, and interview quality control. Each participating organization was assigned a control number. Upon completion, each interview was assigned an accession number to maintain control and facilitate subsequent analysis.

Personal in-depth interviews with the 1500 users lasted an average of 1 hour and 40 minutes per interview. All interviews were conducted in private, to ensure confidentiality and to prevent bias.

Controls

The quality of the analysis depended to a great extent on the quality of the data collected during the interviews. Consequently, appropriate procedures were developed and implemented to assure consistently high quality data and to provide accurate and complete inputs for computer analysis.

Quality control extended from the interview itself, through keypunching of the data, to subsequent analysis. Interview answers were recorded both in precoded and in narrative form. To minimize errors or omissions, each interviewer was required to review and inspect the material from each interview immediately after its completion, but before the next interview. Completed interviews were sent to the project office for review and preliminary audit for completeness, consistency and coding accuracy. Immediate feedback was provided to interviewers when needed to correct errors or improve performance on subsequent interviews.

To reduce errors in transcribing data from the Interview Guide to punched cards, the Interview Guide was designed so that coded responses could be punched directly from the Guide.

An extensive procedure of manual editing and narrative response classification was carried out to ensure the maximum completeness of the data. In this manner the potential "other" and "no response" entries in an interview were largely eliminated. In addition, the computer analysis had various automatic edit and consistency checks built into its routines.

Analysis[5]

The survey data consist of the reports of 1500 interviews, each containing the answers to 53 questions having qualitative responses and 8 questions having quantitative responses.

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[5] This analysis is respectfully dedicated to the memory of Dr. Edith Jay, whose ideas serve as an inspiration to all of us. The great contribution which she always brought to a project was prevented by her untimely passing.

Requirements and Objectives of the Analysis

An analysis should provide a bridge between the data, and meaningful guidelines for management decisions and recommendations for the future. The methods of summarization employed by the analysis should be sufficient to bring both the detailed and general information content of the data into focus. Otherwise, management will be forced to accept only its detailed information content, or to itself perform additional summarization so that its general information content is brought into focus. In order to achieve this:

- The analysis first should summarize the data until their detailed information content is brought into focus. This summary, by its very essence, is limited to only small portions of the flow process at once.
- The analysis then should continue to summarize the data until their general information content is brought into focus, so that both small and large portions of the flow process are described.

The first of these requirements could be achieved by means of frequency distributions for single questions and pairs of questions in the Interview Guide. In addition, the second requirement could be accomplished by an analysis of relationships among questions in the Interview Guide (which represent component parts of the flow process). Such an analysis would yield sufficiently summarized and properly focused general information, describing both small and large portions of the flow process. To achieve this analysis, however, the qualitative data acquired in the interviews must be transformed into a numerical form.

Thus, the objectives of the analysis are to:

- Generate frequency distributions of the answers to single questions and pairs of questions in the Interview Guide.
- Transform the qualitative question responses into numerical form.
- Construct and estimate models for relationships among questions in the Interview Guide.
- Analyze and interpret the frequency distribution and relationship results, in order to provide meaningful guidelines for management decisions and recommendations for the future which are relatively insensitive to changes in the response transformation.

Overview of the Analysis

Detailed information describing small portions of the flow process is provided by one-way and two-way frequency distributions. A one-way frequency distribution is the distribution of the percent of answers to a question that corresponds to each question response, and a two-way frequency distribution is the distribution of the percent of answers to a pair of questions that corresponds to each pair of question responses (see Table 1-1). In addition, the relationship analysis cycle yields general information describing both small and large portions of the flow process.

Table 1-1. One-Way and Two-Way Frequency Distributions

ONE-WAY FREQUENCY DISTRIBUTION

Question 22: Desired Volume of Information Media

RESPONSE	FREQUENCY (%)
All from Recall	7
One Report or Document	30
A Sampling of the Reports and Documents Available	22
All Reports and Documents That Could Be Found Pertinent to the Question	41

TWO-WAY FREQUENCY DISTRIBUTION

Question 25: Desired Depth of Information Media

Question 22: Desired Volume of Information Media		RESPONSE		
		A Once Over Lightly	A Specific Answer	A Detailed Analysis
RESPONSE	All from Recall	0%	5%	2%
	One Report or Document	2%	18%	10%
	A Sampling of the Reports and Documents Available	3%	10%	9%
	All Reports and Documents That Could Be Found Pertinent to the Question	2%	23%	16%

The relationship analysis cycle transforms the qualitative question responses into numerical form, constructs and estimates models for relationships among questions, and then transforms the numerical relationship results back to qualitative form (see Figure 1-3). As illustrated by Table 1-2, the transformation of qualitative question responses into numerical form is accomplished in two steps:

- A detailed structure is developed by grouping the related responses to a question and arranging these groups (and, to the extent possible, the responses within groups) into an informative order. The grouping and arranging are based on the primary unifying characteristic of the question's responses, as determined from the responses themselves and the intent of the question.
- A numerical description of the detailed structure is defined by associating a number with each ordered question response. The base point for a numerical scale is selected, according to the primary unifying characteristic of the question. With each response there is then associated a numerical value, corresponding to its relative "distance" from the base point, along a scale from -1 to 1 (usually from 0 to 1).

Next the construction and estimation of models for relationships among questions are performed in the following four steps:

- Groups of related questions are arranged into an informative and unifying order to form a general structure. To the extent feasible, the arrangement is based on the desirable characteristic that a question tends to influence only those questions which follow it. An example is contained in Table 1-3.
- Pairs of related questions are combined as illustrated in Table 1-3, in order to simplify the specification and estimation of models for relationships among questions in the general structure. Except for rare cases in which a product is employed, all of the combinations of related questions are averages of the numbers previously assigned. The scales remain between -1 and 1 (usually between 0 and 1), in all cases.
- Linear models are specified to represent potential relationships among the combinations of questions in the general structure. (See Table 1-4.) The models are defined in general form to include unspecified constants which, when evaluated, completely determine the model.
- Unspecified constants in the general form of the models are estimated from the data by the technique of regression analysis. Regression analysis also indicates the significance of a relationship and the relative contribution of question combinations to the relationship (see Table 1-4).

Finally, the numerical relationship results are transformed back to qualitative form by a ranking procedure which:

- Ranks question combinations in order of their contribution to each relationship, as shown in Table 1-4.

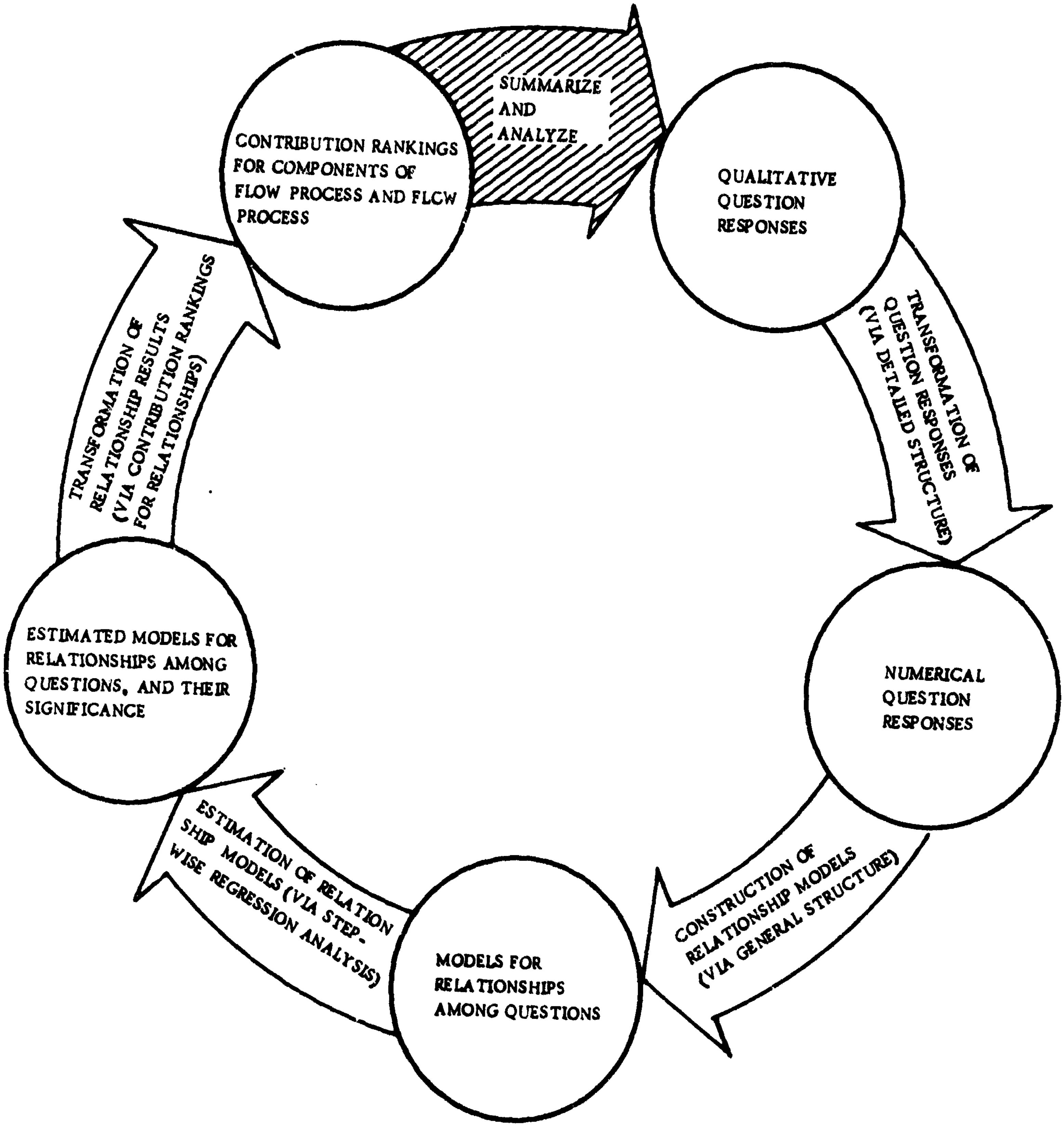

Figure 1-3. Relationship Analysis Cycle

Table 1-2. Transformation of Qualitative Question Responses into Numerical Form

Question 14: First Source for Information

	Informative Order[A]	Scale
I	Received with task assignment	0
II	Recalled it	0.05
III	Searched own collection	0.10
IV	Respondent's own action	0.15
V	Assigned subordinate to get it	0.20
VI	Asked a colleague	0.25
VII	Asked my supervisor	0.30
VIII	Requested search of department files	0.35
IX	Asked an internal company consultant	0.45
X	Searched company information center [B]	0.50
X	Requested library search	0.50
XI	Requested data from vendor, manufacturer, supplier [B]	0.60
XI	Searched vendor, manufacturer, supplier sources	0.60
XII	Searched outside library	0.70
XIII	Asked an external consultant or expert	0.80
XIV	Requested search of DOD Information Center [B]	0.90
XIV	Searched DOD Information Center	0.90
XV	Asked customer	1.00

A. It is instructive to note the evolution of the responses and their order:

1. The 12 responses to Question 40 in the Phase I Interview Guide were reordered and expanded into the 16 responses to Question 14 in the Phase II Interview Guide.
2. Then the 16 responses were expanded to 18, based on an analysis of the answers to the response, "other - specify."
3. Finally the 18 responses were arranged into an informative order, according to their primary characteristic, which may be called "distance from the user."

B. No distinction is made between the two responses in this group of related responses.

Table 1-3. Arrangement and Combination of Questions

USER COMPONENT

A. User's Age: Question 48

B. User's Education

   1. Highest Degree: Question 50A
   2. Field of Degree: Question 50C
   3. Year of Degree: Question 50B

C. User's Experience

   1. Job Experience: Question 51
   2. Company Experience: Question 52

   Combination of Questions: 1/2 (Question 51 + Question 52)

D. User's Position

   1. Kind of Position: Question 55
   2. Field of Position: Question 56

E. User's Level

   1. Equivalent Government Service (GS) Rating: Question 58
   2. Personnel Supervised: Question 49
   3. Type of Activity: Question 54

   Combination of Questions: 1/2 (Question 49 + Question 58)

- Ranks question combinations in order of their overall contribution to the relationships in each component of the flow process and the flow process itself, as illustrated in Table 1-5.

The relationship analysis cycle is believed to be novel in the field of information science. Its employment and testing in Phase II have yielded results that are encouraging, and implications for the future that are provocative.

Analysis and interpretation of the above results produce meaningful guidelines for management decisions and recommendations for the future which are relatively insensitive to changes in the detailed structure and its numerical description. In addition, a comparison is made between the comparable one-way and two-way frequency distributions from Phases I and II; and the Phase I conclusions are reviewed in the light of the Phase II data.

Table 1-4. User Relationships

User Characteristic	Judged Potentially Related To	Related To[A]	Candidate For Relationship[F]
User's highest degree (Q50A)	User'age age (Q48)		
User's field of degree (Q50C)	User's age	User's age[B, C]	User's highest degree[G]
User's experience (1/2(Q51+Q52))	User's age	User's age[D, E]	User's highest degree
User's kind of position (Q55)	User's age, highest degree, field of degree and experience	User's highest degree[B, D]	
User's field of position (Q56)	User's age, highest degree, field of degree, and experience	User's field of degree,[D] highest degree,[B] and age[B]	User's kind of position
User's level (1/2(Q49+Q58))	User's age, highest degree, field of degree, experience, kind of position, and field of position	User's highest degree,[D] experience,[C] age,[C] and field of position[B, E]	

A. Are ranked in order of contribution to the relationship.

B. Coefficient is negative (all other coefficients being positive).

C. Makes a significant contribution to the relationship.

D. Makes a highly significant contribution to the relationship.

E. Relationship is significant.

F. Are ranked in order of potential contribution to the relationship.

G. Would potentially make a significant contribution to the relationship.

Table 1-5. User Ranks*

Combination of Questions \ Related Question Combinations	User's Age (Q48)	User's Highest Degree (Q50A)	User's Field of Degree (Q50C)	User's Experience (1/2(Q51+Q52))	User's Kind of Position (Q55)	User's Field of Position (Q56)	User's Level (1/2(Q49 + Q58))
User's Highest Degree (Q50A)		0					
User's Field of Degree (Q50C)	1	2	0				
User's Experience (1/2(Q51+Q52))	1	2		0			
User's Kind of Position (Q55)		1			0		
User's Field of Position (Q56)	3	2	1		4	0	
User's Level (1/2(Q49+Q58)	3	1		2		4	0
Question Combination Column Total	32	8	49	50	52	52	60
Question Combination Rank	2	1	3	4	$5\frac{1}{2}$	$5\frac{1}{2}$	7

*Table entries are assigned, according to order of appearance in Table 1-4, as follows: 0 to combination of questions in CHARACTERISTIC column: 1 to 1st question combination, 2 to 2nd question combination, . . . , m to last question combination in RELATED TO column; m+1 to 1st question combination, m+2 to 2nd question combination, . . ., $p \leq 11$ to last question combination in CANDIDATE FOR RELATIONSHIP column; and 12, which is omitted for simplicity, to those question combinations not appearing.

Computer Operations

Two basic kinds of computer programs were used in the study:

- Special North American Aviation, Inc. programs used to prepare interview data for analysis.
- Biomedical or BMD programs used in the analysis itself (see Reference 5).

Three of each kind were employed, brief descriptions of which follow.

North American Aviation Data Preparation Programs

- Creation and Updating: This program edits all inputs and creates a new tape, or updates an existing one. The answer to each question is tested for proper code limits and, in some cases, is cross-checked with answers to other questions.

- Reorder: This program assigns the sequence of coded responses, in the detailed structure, to be used for frequency distributions.

- Rescale: This program assigns the numerical values to coded responses.

Biomedical Data Analysis Programs (see Reference 5)

- Transgeneration: This program accepts data created by the Reorder or Rescale Program and combines questions, as desired, for subsequent analysis. The program was used to combine questions as specified in the general structure.

- Two-Way Frequency Distribution: This program computes (a) two-way frequency distributions; (b) Chi-square value and degrees of freedom for each distribution; and (c) means, standard deviations and correlation coefficient for each question associated with the distribution.

- Stepwise Multiple Regression: This general purpose statistical program was used to compute (a) a sequence of estimates for linear models in a stepwise manner; (b) a correlation matrix; and (c) associated significance-level information.

1.5 BACKGROUND

The DOD User-Needs Study was exploratory in nature. It attempted to structure and describe the nebulous process of the flow of scientific and technical information. The study has not completely solved the problems of defining, designing and operating a scientific and technical information program. Some of the reasons for this are:

- The DOD User-Needs Study was the first investigation of its size and scope dealing with a large portion of the information flow process, and its component users and tasks within major segments of the scientific and engineering community.

- The samples from Phases I and II exhibited significant differences in their users, tasks, utilization of information centers and services, and search and acquisition process.

- The Phase II analysis, although compatible with that of Phase I, was more comprehensive and definitive.

- Time and resource limitations precluded the accomplishment of more than a preliminary application of the Phase II analytical approach to the Phase II data, much less its application to the Phase I data.

- Phase II results should be regarded as indicative, but not conclusive, and meriting additional investigation.

On the other hand, the study represents the initial step essential in developing a base of knowledge on which to build future programs. It has investigated the flow process from within, and has concentrated on the study of the user's actual experience relative to specific tasks.

In using and interpreting the results of this study, the following points should be kept in mind:

- Prior to these studies, no definitive description of the composition of the DOD RDT&E and defense industry populations was available. Consequently no attempt was made to select a stratified sample (this is now possible, based on the data acquired in the studies). However, the broad base and large samples used in the Phase I and Phase II studies are representative of the scientific and engineering communities studies. In fact, the Phase II data exhibited strong internal consistency.

- The study technique of investigating "critical incidents" (in this case a specific task that was recently completed by the user) ensured the acquisition of specific data on the flow process. Thus, the data acquired in the study are based on specific experiences in the interviewee's work situation, and not on his opinions, judgments and other generalities.

- The question or information areas covered in the Interview Guide were not closed-end or multiple choice. As asked, almost every question required a free response answer based on the interviewee's task-oriented experience.

- The analysis has concentrated on the over-all sample rather than its compartmentalized segments. Thus a description of particular specialists (e.g., chemists, electrical engineers, etc.), although feasible, was not attempted.

- The questions and pairs of questions dealing with INFORMATION (as opposed to those dealing with the USER, TASK or UTILIZATION) should be considered as exclusively INFORMATION descriptors, in that they are drawn from a different data base than the other descriptors (i.e., any one USER and TASK can have from one to five information units associated with them).[6]

- Conclusions involving combinations of questions should not be drawn from the frequency distributions of single questions, but only from those involving pairs of questions and the models of relationships.

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[6] Twenty-four percent of the USERS perform TASKS which had an output associated with a design or design technique; but the 10 percent of INFORMATION that related to design or design techniques represents 547 of the 5339 separate information units that were used in the survey tasks. These 547 information units could have been used by anywhere from 7 percent to 36 percent of the USERS. Therefore, INFORMATION questions identify INFORMATION characteristics and not those of USER, TASK or UTILIZATION.

- In order to analyze the data, the qualitative responses were transformed into numerical form as described in Section 1.4. One must take this transformation into account in order to apply the results of this study intelligently to information programs. If a different transformation is desired, then certain portions of the analysis should be repeated with the new transformation.

- Regression analysis estimates of models describing the flow process are sensitive to changes in the detailed structure and its numerical description, and in the general structure and its combinations of related questions. The model estimates in Appendix 13 and Volume III must then be taken as relative, and not exact. However, the guidelines for management decisions in Section 1.2 have been obtained from the model estimates via a ranking technique which is relatively insensitive to such changes. This technique is described in Section 4.

- Employment of the terms, input and output, to describe relations and factors within the flow process not only provides insight into the flow process, but also facilitates the analysis of the process and the design and analysis of the information system which serves it. One must realize, however, that regression analysis can merely characterize and indicate the significance of a relationship. It cannot imply a cause-and-effect relationship, for this can only be accomplished by thorough knowledge of the flow process.

1.6 ORGANIZATION OF VOLUME II

The essence of Phase II may be obtained by reading Section 1. Sections 2 through 8 present the technical description of the study. Details will be found in the appendices. For the reader's convenience, Volume II is divided into two parts:

- Volume IIA, which contains Sections 1 through 8.

- Volume IIB, which contains Appendices 1 through 15.

Section 2 deals with the development, interpretation, and use of the Interview Guide. Interviewer training, survey planning, and data collection and pre-processing are discussed in Section 3. Section 4 describes the analysis in terms of frequency distributions and the relationship analysis cycle of transforming qualitative question responses into numerical form, constructing and estimating models for relationships among questions and then transforming the numerical relationship results back to qualitative form.

In Section 5, the findings regarding frequency distributions are presented. Section 6 is concerned with significant relationships and input and output factors within the flow process. The comparison of Phases I and II is developed in Section 7. Recommendations for the future appear in Section 8.

The participating organizations are listed in Appendix 1. Appendices 2 through 6 relate to the Interview Guide; Survey operations are covered by Appendices 7 through 11. Appendices 12 through 14 support the analysis and its results; Finally, Appendix 15 documents the computer operations.

The word "chunk" was used in both Phases I and II to represent an information unit. A chunk is the smallest identifiable and meaningful quantity of information which is required in the conduct of a task. Although suppressed from Volumes I and III for improved readability, it appears in Volume II for technical accuracy.

Throughout the volume, the following abbreviations have been used:

- DDC - Defense Documentation Center
- DOD - Department of Defense
- GS - General Schedule
- Q - Question
- STAR - Scientific and Technical Aerospace Reports
- TAB - Technical Abstract Bulletin
- TIC - Technical Information Center

2. INTERVIEW GUIDE

The vehicle for collecting the data to determine the information acquisition patterns of scientific and technical personnel within the defense industry was a personal interview. The interview was "standardized", since the same (or predominately the same) information was collected from each respondent through the use of equivalent questions. As the respondent sample represented many disciplines and levels (e.g., education, management, effort, etc.) and the interview topic was not common, widely discussed, or understood, the interview was "nonscheduled" in nature. Consequently, the interviewer had flexibility in asking questions which would elicit the information required from the respondent. Nonscheduled interviews assume that if questions are to have the same meaning to each respondent, they must be formulated in a wording that is appropriate for each interviewee. Thus the interviewer, having been trained in the meaning of the basic questions and knowing what information was required during the interview, was allowed to vary the wording and to some degree the sequence of the questions to best fit the respondent. The interview was predominantly a "free response" setting where there were very few explicit bounds upon the response of the interviewee. The respondent was encouraged to talk freely of his experiences and give examples of his information search and acquisition patterns.

In some instances there was no need to ask each of the explicit questions during an interview as the respondent may have already answered them during his discussion of previous questions. In these cases, the interviewer simply encoded the appropriate response to the question without further investigation. The response categories covered the majority of the interviewee's possible responses. In some cases, the questions were closed and could be answered in a few words or had limited responses, i.e., the respondent's answers must fit into the response categories that were supplied. Any response that did not readily fit into the categories which were listed was inserted in a space provided for "other" responses and an example or explanation of the unique response was recorded.

2.1 DEVELOPMENT

A primary contractual requirement was the modification of the interview guide used during Phase I of the study. This modification was necessary due to the change in the nature of the population to be surveyed in Phase II.

Modifications to the Phase I Interview Guide were required in two major areas: (a) tailoring it to the defense industry population; and (b) overall improvement based on the results of Phase I, technical evaluation by NAA, and a pilot test. The principal modifications to the Phase I Guide were to:

- Reorganize it, by removing extensive tables and including them in a separate Interview Reference Manual.
- Improve the printing and layout, making it easier to record data during interviews.
- Provide increased logical order of questions.
- Minimize the number of questions (e.g., by letting one group of related questions cover an entire subject, when possible).

- Assess the utilization of company Technical Information Centers.
- Assess the utilization of Non-DOD Specialized Information Centers.
- Investigate restrictions on availability of technical information.
- Provide for mutually exclusive responses.
- Expand, reorient and rearrange question responses.

Modification Cycle

The modification of the Interview Guide was accomplished as follows:

- Upon award of the contract an NAA task group reviewed the Phase I Final Report, placing special emphasis on developing recommendations for modifying the Interview Guide. At the initial program review meeting these recommendations were discussed with representatives of DOD who provided additional guidance.

- Based on results of this meeting, a draft modification (dated 23 June 1965) was submitted to the Technical Officer, who monitored the contract for DOD. Included in this submittal was a draft Reference Manual along with comments on the revision of the Interview Guide Handbook. Suggested revisions in format and layout were also incorporated in this draft (see Appendix 2).

- This draft modification was reviewed by DOD and subsequently discussed at a meeting held in the Office of Mr. W. M. Carlson, Director of Technical Information, Office of the Director of Defense Research and Engineering, at the Pentagon. Additional modifications were suggested at this time, and a more appropriate version of Table VII (DOD Information Analysis Centers) was provided by Mr. Carlson for inclusion in the Interview Reference Manual (Appendix 6).

- On the basis of agreements reached at this meeting, the 26 July 1965 editions of the Interview Guide, Handbook, and Reference Manual were prepared. These documents were used in the interviewer training and the pilot test.

- On the basis of the pilot test and final review of the documents by the Technical Monitor, DOD and NAA, the final editions of these three basic documents were prepared and published on 1 August 1965 and were used in the survey.

Initial Modification of Interview Guide

A basic principle in modifying the Guide was the full utilization of all relevant materials and results of Phase I. This was particularly important because of the limited time allowed for modification and the planned comparison of Phase I and

Phase II. Therefore, to achieve the improvements indicated as necessary by the result of Phase I experience and to satisfy the different audience of Phase II, modifications were made as follows:

- The format of the Interview Guide questionnaire was revised to simplify recording, transcription, reduction, and analysis of all data.
- Those questions pertaining specifically to DOD personnel information acquisition, sources, and use were replaced with questions permitting the interviewee to specify the sources sought out by the defense industry for scientific and technical information, and their acquisition techniques and uses of such information. Additional questions to disclose and validate other information characteristics were developed. The Interview Guide was adapted to allow interviewing of personnel such as quality control inspectors, engineers, production engineers, chemists, physicists, aeronautical and astronautical scientists, and other industry-oriented personnel.
- Questions were incorporated regarding the characteristics and source of oral, as well as written information. These questions were intended to disclose the amount of orally acquired information: (1) the reason why it was so acquired as opposed to graphic or documented media, (2) sources of oral information, e.g., co-workers, professional associations, meetings, and consultations, (3) the degree of confidence placed in orally acquired information, and (4) the value of the information to the performance of specific tasks.
- Questions designed to determine the type and source of engineering information sought were formulated and evaluated.
- Since the User Profile should be the final topic covered, it was placed at the end of the interview.
- Appropriate questions were incorporated to elicit information regarding utilization of company information centers and services.
- Responses were made mutually exclusive.
- To provide sharper and clearer industrial user profiles, the terminology included in the Interview Guide was modified. This included using appropriate industry classifications, job titles, and descriptions; amplifying the "Type," "Kind," and "Field-of-Activity" categories to encompass the wide diversity of industrial efforts; and eliminating or replacing other terms unique to DOD or other Federal Government agencies.
- Responses were categorized wherever feasible. These categorizations are based primarily on the analysis of Phase I, additions required due to the character of the Phase II population, and attempts to clarify and make interrelated questions comparable. An analysis of the Phase I responses defined as "other" also provided additional response categories.
- Blank responses (i.e. no answer) obtained in Phase I were reduced or eliminated. These blank responses occurred most frequently in the responses related to chunks or units of information. The majority of these blank responses were related to chunks of information recalled

from the respondent's previous experience. In order to eliminate such blank responses new specific answer categories related to recall, previous experience, or previous knowledge were added.

To facilitate the interviewer's tasks and to expedite interviews, interviewers were supplied with three basic interview documents:

1) The Interview Guide, Appendix 5

2) The Interview Guide Handbook, Reference 4

3) Interview Reference Manual, Appendix 6

All three were used in conjunction with the interviews. For detailed notes explaining the nature of these initial changes to the Interview Guide see Appendix 2.

26 July 1965 Edition of Interview Guide

The review of the draft Interview Guide led to further modifications which were reflected in the 26 July edition of the Interview Guide. These changes included expansion of categories, clarification of the questions, rephrasing, and change in sequence of items to reflect a more logical order. For detailed comments on these modifications see Appendices 2 and 3. In addition, a revised format was incorporated, including punch card layout and keypunch instructions. This reformatting was designed to simplify recording entries, while at the same time simplifying input for subsequent keypunching. Also, all responses were assigned numerical codes.

Pilot Test and Final Edition of the Interview Guide

The 26 July edition of the Interview Guide was subjected to a pilot test to authenticate the revisions. Twenty interviews were conducted among NAA engineering/scientific personnel in various corporate divisions and job classifications. During the pilot test, the interviewers made a concerted effort to determine whether questions were understood and answered properly. Records were made of problems, unclear questions, and relevent comments by interviewees (e.g., meaning of questions, difficulties in replying, how questions might be asked differently, and the need for additional categories). The interviewer recorded his own observations, criticisms, and suggestions. These matters were explored during a comprehensive debriefing session.

The pilot test interviews and the 26 July edition of the Interview Guide were then subjected to an additional detailed analysis which resulted in further modification leading to the final edition of the Interview Guide (dated 1 August 1965). The principal result of the pilot test was a reorganization of the sequence of questions. The pilot study revealed that there was not a smooth flow, or logical stepwise progression associated with the sequence of questions in the 26 July edition. During an analysis of chunk and task information, it became clear that there was too much jumping back and forth from general to specific items (e.g., source to media to source to layout). Therefore, the questions were reordered into a more logical sequence by grouping source, time, and media items. At the request of Mr. Carlson, Questions 42 and 43, concerning problems encountered due to restriction of information, were rephrased because they could tend to be "leading" questions. The questions also did not offer the interviewee an opportunity to provide information on other problems

involved with restrictions on obtaining information. For detailed explanatory notes on this revision, see Appendix 4.

The final interview guide consists of five basic parts: (I) analysis of information concerning a recently completed task; (II) utilization of information and data centers; (III) difficulties usually encountered in obtaining technical information; (IV) respondent profile; (V) subjective comments of the interviewer. A more detailed breakdown would be:

I. Analysis of task information (questions 1-32)

  A. Isolate the task (question 1)

  B. Task data (questions 2-10)

  C. Isolate the task information chunks (question 11)

  D. Chunk data (questions 11-32)

II. Utilization of information centers (questions 33-44)

  A. Use of company information centers (questions 33-36)

  B. Use of TAB and DDC (questions 37 and 39)

  C. Use of STAR and English abstracts and translations (questions 38 and 44)

  D. Use of specialized information and data centers (questions 40 and 41)

  E. Effect of restrictions on obtaining and using scientific and technical information (questions 42 and 43)

III. General information patterns: difficulties usually encountered in obtaining technical information (questions 45-47)

IV. Respondent profile (questions 48-58)

  A. Personal data (questions 48-53)

  B. General job description (questions 54-58)

V. Subjective comments of interviewer (questions 59-63)

2.2 INTERVIEW AIDS

The Interview Guide Handbook

The Interview Guide Handbook (Reference 4) describes the interviewing techniques and tools used in Phase II of the DOD User-Needs Study, and was particularly important to the interviewer for its detailed discussion of the questions. It contains the explanation of and instruction in the interviewing method, questions to be covered, and interviewer aids available. In addition it was the basic tool for training the interviewers.

The Interview Guide Handbook is organized into four basic parts, each representing a major segment of the study's documentation:

- Handbook Text
- Interview Guide
- Interview Reference Manual
- Synopsis of Interview Topics

The Handbook text comprises the primary content of the book. It is the discussion of the study, the scientific and engineering process, and the interview. Appended to the text were reproductions of the Interview Guide, the Interview Reference Manual (an easy reference document on 5" x 8" cardstock for use during the interview), and a Synopsis of Interview Topics (a short summary of the basic interview questionnaire which is sent to each respondent prior to his interview). They also appear below as Appendices 5, 6, and 8.

As was the case with the Interview Guide, the Interview Guide Handbook was developed in two phases. The initial version dated 26 July 1965 was used in training and in the pilot test, and was then revised on the basis of the pilot test results and comments made during training and analysis; the final edition, dated 1 August 1965, was utilized in the conduct of interviews.

Development of the Interview Guide Handbook was governed by a recognition that the Handbook was to serve basically as an instructional document on the background, objectives, and conduct of the study and as an interviewer reference. Topics such as items to cover in the introductory phase of an interview and how to use the new Reference Manual were also included. Examples of chunks derived from an analysis of Phase I interview responses were added to give the interviewer a more realistic and meaningful concept of this vital part of the interview. The Interview Guide Handbook also included the basic study correspondence, a directory of participating companies, and a glossary of terms.

A study of the Phase I Final Report indicated that discussion of retrieval time, information time, and depth of subject matter was not necessary. Consequently, these topics were dropped from the final edition of the Interview Guide Handbook.

Interview Reference Manual

In order to facilitate the mechanics of the interview a reference manual was developed for use by the interviewers. It contained a series of response categories and instructions for use during the interview. The Reference Manual is spiral bound at the top, and contains the following lists:

I. Points to Cover in Introduction

II. Classes—Definitions of types of effort (used with questions 8, 28)

III. Kinds—Definitions of areas of effort (used with questions 9, 55)

IV. Fields—33 distribution fields as defined by the Defense Documentation Center (used with questions 10, 29)

V. Media—The method of information transfer (used with questions 18, 20)

VI. Physical Layout—The format of the transferred information (used with questions 26, 27)

VII. Department of Defense Information Analysis Centers—A selected list of DOD specialized information and data centers (used with question 40)

VIII. GS Rating Equivalency—A set of salary ranges that are approximate equivalents of Federal Classification Act General Schedule (GS) Grades (used with question 58)

For particular questions, some of these lists were shown to the respondent to give him an easily handled reference to the categories of items from which he was asked to select his response. In other cases, the Reference Manual was shown to the respondent only if needed. Some lists were used only by the interviewer and applied to more than one question in the Interview Guide. The Interview Guide had a note to the interviewer when the use of the Reference Manual was required.

The codes from the Reference Manual plus the codes for Degree Field and Military Occupational Specialty (MOS) are included in Appendix 6.

2.3 INTERPRETATION

In order to adequately interpret the results of this study, one must have an understanding of various terms and categories. This section will present a set of definitions of the terms and response categories that may be ambiguous or misinterpreted, and a discussion of the classification and recategorization of question responses accomplished during the data editing phase.

Definitions:

TASK - A respondent will have completed many tasks; however, the particular one of interest to the interviewer was the most recently completed task that met the following additional three criteria:

- It required a total of eight full hours or more of the respondent's efforts.
- It involved technical considerations.
- It had a tangible, clearly identifiable output such as a technical report or an oral briefing.

CHUNK - In order to complete a task certain information must be defined, the source located, and the information acquired. Tasks usually required more than one type or classification of information; each of which may have different search and acquisition, content, or composition characteristics. Therefore, the first step in defining the scientific and technical information process was to determine what information was required for each task under investigation and then define the best set of classifications to identify the various types of information involved. These classifications were narrative descriptions of the definable natural units of information required for a task and were referred to as information chunks.

It must be emphasized that the chunk is a description of the type and quantity of information, and not the physical package or media (textbook, journal, etc.) in which the information comes. A particular chunk, regardless of its type, size, or complexity, may come in one or in one thousand varied media. The chunk and media have no direct relationship.

MAJOR TASK OUTPUT - The outputs of tasks were classified as:

1. Technical data or information - Unanalyzed or unsynthesized data and information in its original form.

2. Finding - A simple recording of the results discovered in an investigation, with no specific recommendation to act on any of the alternatives presented. For example, one finding determined that there are two feasible methods for generating electricity to power a particular communications satellite; these methods are thermoelectric and thermonuclear.

3. Recommendation - A suggestion to follow one of a number of alternatives. An example would be a respondent's advice to use the thermonuclear source of electricity for the satellite.

4. Decision - A decision to take action or not take action on a recommendation from others, or on findings generated, and deliberated over, by the respondent. An example of a decision is the conclusion to order immediate development of a thermonuclear generator.

5. Plan - A procedure for carrying out a subsequent or future task or project.

6. Design (includes specification) - A set of detailed requirements for the utilization or development of some item or system.

7. Hardware - Some product or developmental item.

CLASS - This description, which is used to describe the task and information chunks, refers to the type of information content of an output or a chunk. The response categories are:

1. Concepts - Theories, ideas, broad technical plans, or general relationships. For example, the plan for lunar orbit of a manned spacecraft preparing to descend to the moon, or the theory of relativity.

2. Cost and Funding and Administration Action - The allocation or expenditure of money in support of a technical effort. For example, budget data for the coming fiscal year or for the development of a new land mine.

3. Design or Design Techniques - Detailed approaches or procedures employed in combining ideas, and the techniques of converting these combinations into plans and models.

4. Experimental Processes or Procedures - The method or sequence of events followed in preparing and performing an investigation where the results are predicted theoretically and not with absolute certainty.

Experimental processes and procedures may either be generally established ways of setting up or conducting experiments, or they may be one of a kind. An example is the procedure for conducting a wind-tunnel experiment to determine the drag on a model of a new supersonic aircraft configuration.

5. Math Aids, Formulae, and Computer Programs - Theorems, equations formulae and computer program considered as standard information by accepted authorities and used as tools in calculations.

6. Performance and Characteristics - Observed data or qualities of an object in terms of what it is or how well it performs. For example, a high-wing monoplane has a measured speed of 825 knots. Performance and characteristics indicate the actual nature or capability of an object, not the design objectives of the object (i.e., not specifications).

7. Production Process and Procedures - The method or sequence of events involved in the fabrication of an object.

8. Raw Data - Unprocessed and uncorrected data that are the primary record of a scientific or technical measurement or event. For example, a graphical record of telemetry data exactly as it appeared when it was radioed from a rocket; a high-speed photograph of the shock waves produced by a projectile.

9. Specifications - Primarily quantitative descriptions of how well an object is expected to perform. For example, "The proposed aircraft must cruise at 1000 knots"; "...the chassis is to withstand shock of 40 g's"; "...it is required that the computer be able to operate in an environment of -50 degrees to +100 degrees C." Specifications are theoretical expectancies, not what an object is or can do (i.e., performance and characteristics).

10. Technical Status - The present condition, accomplished to date, or state of the art in a scientific or technical area or project. For example, a quarterly progress report detailing the accomplishments in the development of a new rocket propellant.

11. Test Processes and Procedures - The method or sequence of events involved in determining the characteristics, capabilities, or limitations of an object that has been produced in quantity. For example a procedure for conducting desert trials of a production model of an Army tank, or procedures for evaluating durability of common textiles.

12. Utilization - The scheme for employing material or equipment in particular situations; where and how an object functions within a system. Utilization may also include the procedures employed by personnel in operating a system.

13. Evaluation - The scheme for evaluating some aspect of a developmental or operational system or item.

KIND - This descriptor, used to describe task, information chunk and the interviewee is the definition of an area of effort. The categories of kind are in effect elements of the research, development, test, evaluation, and production cycle. The specific response categories are:

1. Applied Research - Includes any research effort that is directed at the solution of a particular problem and is tested under conditions of application. Thus, research involving the use, application, or evaluation of a specific item of equipment or software would be applied research. This type of effort may include fundamental applied research or quite sophisticated breadboard hardware, study, programing, and planning efforts. It would thus include studies, investigations, and relatively minor exploratory development effort.

2. Basic Research - Includes any research taken from a theoretical point of view with the aim of testing hypotheses. The item selected for study and the methods employed are selected in terms of their appropriateness to the conceptualization under consideration. The results of such research have wide generality along specified conceptual dimensions.

3. Advanced Development - Includes all projects that have moved into the development of hardware for experimental or operational test. They are characterized by line item projects, and program control is exercised on a project basis. A further descriptive characteristic lies in the design of such items being directed toward hardware for test or experimentation, as opposed to items designed and engineered for eventual service use. Examples are testbeds such as an experimental hydrofoil and the X-15.

4. Engineering Development - Includes development programs being engineered for service use but not yet approved for procurement or operation. For example: MAULER, TYPHON, B-70. This area is characterized by major line item projects.

5. Operational System Development - Includes development effort directed toward development, engineering, and test of systems, support programs, vehicles, and weapons that have been approved for production and service employment. This area is included for convenience in considering all projects. All items in this area are major line item projects.

6. R&D Support - Includes research and development effort toward support of installations or operations required for general research and development use. Test ranges and maintenance of test aircraft and ships would be included. Examples of research and development support are calibration of nozzles used in a wind tunnel; design of a piece of general test equipment, such as a chronograph, that is to be used by laboratory personnel, not by field forces, to measure the speed of an artillery shell.

7. Test or Evaluation - Includes all efforts directed at test and evaluation of developmental or operational systems and items. Tests and evaluation that are part of a research project will be included under category 1.

8. Production Processes - Includes all production aspects that are not directly associated with the end item. These include areas such as maintenance.

scheduling, purchasing, warehousing, etc. Exempted from this category are test and evaluation, and reliability or quality control efforts.

9. Production End Items - Includes all activities directly associated with the production of end items.

10. Reliability or Quality Control - Includes maintaining the quality of a product by using mechanical and mathematical sampling and measuring techniques.

11. System Analysis - Includes any analysis of a system that leads to a detailed description of the components, operating conditions, functions, and interactions. Requirements analysis, capabilities analysis, and feasibility analysis are included.

12. Customer Relations - Includes all efforts that are related to direct customer interaction (e.g., sales, briefing, coordination, etc.).

Classification and Recategorization

In order to carry out adequate structuring and analysis of the interview data it was necessary to obtain "clean" data. That is, data that are complete, non-contradictory, mutually exclusive, precise and meaningful. During the data edit and preparation phase, each question was analyzed for these qualities and any adjustments that were obviously required and justified by the rest of the data in the individual interview guide were made. One basic change made was to recategorize the structure of Question 3 - Elapsed time of task. The question was organized in the Interview Guide by small time increments (e.g., less than 1 day, 1 day, 2 days, etc.). Preliminary analysis indicated that the categories supplied were too restrictive at the upper end (more than 28 days being the highest category and containing 62% of the responses) and too broad at the lower end of the scale. By using the times indicated in the "Specify" section of the question, a new set of response categories was defined and used in the analysis.

There are eight questions in the interview that were entirely narrative in nature. Five of these narrative questions were analyzed and response categories were developed for them.

A majority of the questions in the interview guide - some 34 of the 55 non-narrative questions - had open-end response categories (explain, other, or combinations). The entries in these open-end response categories were extracted from the interview guides and reviewed for content. Many of the responses were included in the standard question response and others comprised new response sets. During the review the open-end responses were either incorporated into the standard responses of the questions or new response categories were defined and included in the analysis.

The remaining paragraphs of this section define what was done with each Question and describes any changes in the categorization of responses.

Question 1 - Narrative question - No categorization attempted.

Question 2 - Responses (7) "Some combination of the above (Specify)" and (8) "None of the above (Explain)", were reassigned within categories (1) - (6). The reassignment was on the basis of the most

"authoritative" originator or the one which is a logical buffer or catalyst for task initiation. A buffer would be the position of a supervisor between the respondent and higher management or higher management between the customer and the respondent. These determinations assumed a normal organizational channel of assignment (worker - supervisor - management - customer). A catalyst would be a decision of respondent and colleagues in the application of standard procedures, or the supervisor in a combination of initiative of respondent, or decision of respondent and colleagues with direction of immediate supervisor. Of the 39 open-end responses, all were categorized.

Question 3 - Question 3 on total elapsed time of task was completely reorganized. The initial categories proved to be too small at the lower end of the scale (1-7 days) and to not have enough area at the upper end (the 10% of tasks lasting 1-7 days was broken into five categories and those lasting more than 28 days, which contained 62% of the responses, were contained in only one category). The new categories were:

1. 1-7 days
2. 8-14 days
3. 15-21 days
4. 22-28 days
5. 29-90 days
6. 91-180 days
7. 181-270 days
8. 271-365 days
9. Over 365 days

Question 4 - No "open-end" responses.

Question 5 - The "other" responses to Question 5 were reassigned within Categories (1) - (7). Only five items remained in the "Other" category: these were four that dealt with chemical compounds and one that had a "trained individual" as the task output.

Question 6 - The categories of (5) - "Some combination of the above (Specify)", and (6) "Other (Specify)", were reassigned to categories (1) - (4) or to a new category of (7), Hardware. Those combinations of formal - informal or documentation - briefing were reassigned to the "more formal" of the noted categories.

Question 7 - No new categories were developed for Question 7. Responses to (8) "Some combination of above (Specify)", and (9) "Other (Specify)", were reassigned to categories (1) - (7). The following ground rules were used:

1. Combinations were assigned to the most logical recipient of the data, e.g., if the combination was (2) "Individual(s) within the respondent's company", and (6) "DOD," the reassignment was to (2) - as individuals within the company would probably be a buffer between the individual and DOD.

2. Vendors, manufacturers, and suppliers were considered a segment of industry.

3. Consultants were considered a member of the respondent's profession.

Question 8 - Of the 23 "Other" responses to Question 8, all were reassigned within responses (1) - (13) after review of the individual interview guides.

Question 9 - By reviewing the individual interview guides the 28 "Other" responses were reassigned within categories (1) - (12).

Question 10 - The "Other" responses to Question 10 were mostly related to aerospace (63 of 81) and were reclassified as (01) "Aircraft and flight equipment". After individual interview guide reviews almost all remaining "other" responses were reassigned within categories (1) and (53). The 6 responses that remain unclassified were blanks.

Question 11 - Narrative - No categorization attempted.

Question 12 - There were 72 responses to Question 12 which were stated as (6) "Not applicable (Explain)". These responses were all reclassified into responses (1) - (5) or assigned to the new classifications of:

(7) Received only part of chunk
(8) Task generated chunk
(9) Distribution process produced chunk

Question 13 - The responses to category (6) "Not applicable (Explain)", were generally statements of no time restraint on the task and thus no time requirement for the information. Most other responses concerned chunks without which the task could adequately proceed. These responses and those listed under (5), "More than 30 days", were analyzed in light of task duration and assigned to the most appropriate category under a new category scheme: categories (1) through (4) remained the same, while (5) became 31-90 days and (6) became more than 90 days.

Question 14 - Three new response categories were developed for Question 14. They were:

(17) "Asked customer"
(18) "Asked an external consultant or expert"
(19) "Respondent's own action"

All 390 "Other" responses were reassigned to these new categories or back into the original response categories of (1) - (15).

Question 15 - Fifty-eight of the 66 "Other" responses to Question 15 were reclassified back into responses (1) - (6). The 8 which were not categorizable were chunks which were not received.

Question 16 - Question 16, which is narrative in form, was reviewed and categorized by "Class". One new category, (15) Requested information about an information source, was added to the "Class" list for question 16 only.

Question 17 - No "open-end" response.

Question 18 - No new categories were created for question 18. All but 13 of the 111 "Other" responses were re-categorized under responses (1) - (27). The following definitions were used in the reclassification:

1. Personal visits to (8) Oral contacts - all other
2. Observations or Samples to (25) Physical measurements or experiments
3. Records, forms or RFP's to (11) Correspondence, memos, and TWX (informal correspondence)
4. Tapes and Cards to (23) Computer printouts
5. Specifications to ([illegible]) Standards and codes
6. Patents to (13) Reports

Nine of the items not categorized were for chunks not received. The other four related to abstracts or indices.

Question 19 - The "Specify" responses to Question 19 have been categorized by the media definitions for Question 18 and 20.

Question 20 - Same procedure as Question 18. All 99 "Other" responses were reclassified.

Question 21 - All but 15 of the 64 "Other" responses to Question 21 were reassigned within responses (1) - (4). The 15 uncategorized responses were all concerned with chunks that were never received.

Question 22 - All but two of the 44 "Other" responses to Question 22 were successfully reassigned within responses (1) - (4). The two uncategorized chunks were not received by the respondent.

Question 23 - Response (3) "Would not have been useful (Explain)", was analyzed for pertinent groupings of responses.

Ten categories were developed, and the 3051 responses that gave adequate explanations were assigned to the categories. The following are the categories used:

(1) Had or knew location of data
(2) Subject was too specific for title listing or abstracts
(3) Information was recalled
(4) Information received from personal or oral contact
(5) No published or indexed information available on the subject
(6) Received with task or from normal distribution procedure
(7) Required raw data

(8) Use of title listings or abstracts takes too much time
(9) Internally generated information
(10) Title listings and abstracts not applicable

Question 24 - No "open-end" response.

Question 25 - No "open-end" response.

Question 26 - Three new categories were created for Question 26. These are:

(16) Graphics, text and oral
(17) Graphics, text, oral and recall
(18) Narrative text and lists and tables

By using these three new categories, all but 35 of 829 "Other" responses for Question 26 that had explanations were reassigned. The 35 that were uncategorized involved physical observations (25 chunks) and data not received (10 chunks).

Question 27 - The new categories derived for Question 26 were also used to reassign 633 of the 654 "Other" responses to Question 27. The twenty-one responses that were not recategorized involved physical observations (16) and no data received (5).

Question 28 - All 76 of the "Other" responses to Question 28 were reassigned to Categories (1) - (27) after review of the individual interview guides.

Question 29 - 172 of the 278 "Other" responses to Question 29 were "Aerospace" and were reassigned to (01) "Aircraft and flight equipment". All but 17 of the remaining 106 responses were reassigned to (2) - (28). These 17 were all combinations of (14) and (17), Materials (nonmetallic) and Metallurgy.

Question 30 - No "open-end" response.

Question 31 - The "Other" responses were reassigned.

Question 32 - The "Explain" of response (1) were not categorized.

Question 33 - No "open-end" response.

Question 34 - The "Other" responses to Question 34 were reviewed, and those services listed which were considered unique (translation, reproduction, book purchase, etc.) were retained under (9), "Other". All the rest were dropped or reassigned to responses (1) - (8). Therefore response (9) "Other", is now interpreted as "Special Services, e.g., translation, reproduction, book purchase, etc."

Question 35 - No "open-end" response.

Question 36 - There were 237 (6) "Other", responses for Question 36. These were reassigned to the applicable standard response (89 responses) or to one of 5 new categories:

(6) Not complete enough (coverage inadequate)
(7) Services inadequate
(8) Personnel inadequate (not enough or of poor quality)
(9) Structure and/or mechanics poor
(10) Entire library is incomplete

Question 37 - No "open-end" response.

Question 38 - No "open-end" response.

Question 39 - The 7 "Other" responses were reassigned within the response categories. The "For what kind of information?" section of response (1) has been organized by field.

Question 40 - All 22 of the "Other" responses were reassigned within the response categories.

Question 41 - The 'Which ones?" response within (1) Yes have been organized by:

(1) Colleges and Universities
(2) Professional Societies
(3) U.S. Government
(4) Private Organizations
(5) Foreign Organizations

Question 42 - No "open-end" response.

Question 43 - The "Explain" sections of Question 43 were organized within the categories of: Proprietary - (1) Vendors, (2) other Companies, and (3) miscellaneous; and Security - (1) No proper need-to-know, (2) too difficult to establish need-to-know, (3) too long to establish need-to-know, (4) too difficult to acquire information and (5) too long to acquire information.

Question 44 - The language and source of English translations and abstracts of foreign literature were classified.

Question 45 - No "open-end" response.

Question 46 - The 628 meaningful narrative descriptions of the difficulties encountered by the respondents were assigned to the following categories:

(1) Utility of information (internal or external to company, or both)
(2) Timely acquisition of information (internal or external to company, or both)
(3) Timely awareness of information (internal or external to company, or both)

Question 47 - The narrative responses were categorized as follows:

(1) Implementation of available procedures or administration action.
(2) Publicity and training.
(3) More professional contact.
(4) Improvement of subject reporting and coverage.
(5) Improvement of subject.
(6) Improvement of organization of subject data or documentation.
(7) Improvement of indexing, abstraction and classification.
(8) Use of periodic workshops, information centers, clearing houses, symposia or other central sources for information.
(9) Improvement of dissemination techniques.
(10) Improvement of dissemination by making more copies of documentation available.
(11) Improvement of dissemination by reducing lag time.
(12) Use of automatic data processing.

Question 48 through 52 - No "open-end" response.

Question 53 - Narrative - combined with Question 57.

Question 54 - The 40 "Other" responses in Question 54 were reassigned within the response categories.

Question 55 - After review of the individual interview guides the 74 "Other" responses were recategorized within the response categories.

Question 56 - Question 56 was handled like Questions 10 and 29. All "Other" responses were reassigned.

Question 57 - Narrative; all responses were analyzed in combination with Question 53 and an MOS code was assigned to each individual (See Appendix 6).

Question 58 and 59 - No "open-end" response.

Question 60 - The narrative responses to Question 60 were analyzed and assigned to categories.

The patterns were categorized on the basis of the maximum relative distance the respondent went to obtain technical information and data.

(0) Does not know how to go about obtaining information and data.
(1) No additional opinion or no observable pattern.
(2) Uses information he has, recalls, or generates.
(3) Uses information which comes to him with the task or through automatic distribution.
(4) Seeks information at his department level or lower (e.g., subordinates, colleagues, supervisor, department files).
(5) Seeks information beyond the level of his department but still within the company (e.g., company consultants, company library).

(6) Seeks information outside his company but uses company channels.
(7) Seeks information outside his company on his own.
(8) Uses personal contacts as sources (location of source not specified).
(9) Excellent patterns, uses all or most sources available.

Questions 61, 62 and 63 - No "open-end" responses.

3. SURVEY OPERATIONS AND CONTROLS

This section describes the principal tasks that were required to prepare for and conduct survey operations, and to prepare data for analysis. These activities included:

- Selection and training of interviewers
- Survey planning and operations, including vigorous follow-up to obtain required sample size
- Data collection and editing

Immediately upon notification of the award of this contract, the project organization (see Figure 3-1) was activated and contract efforts initiated.

3.1 INTERVIEWER SELECTION AND TRAINING

Selection of Interviewers

Selection and training of the staff of interviewers were considered of critical importance to the successful conduct of the study.

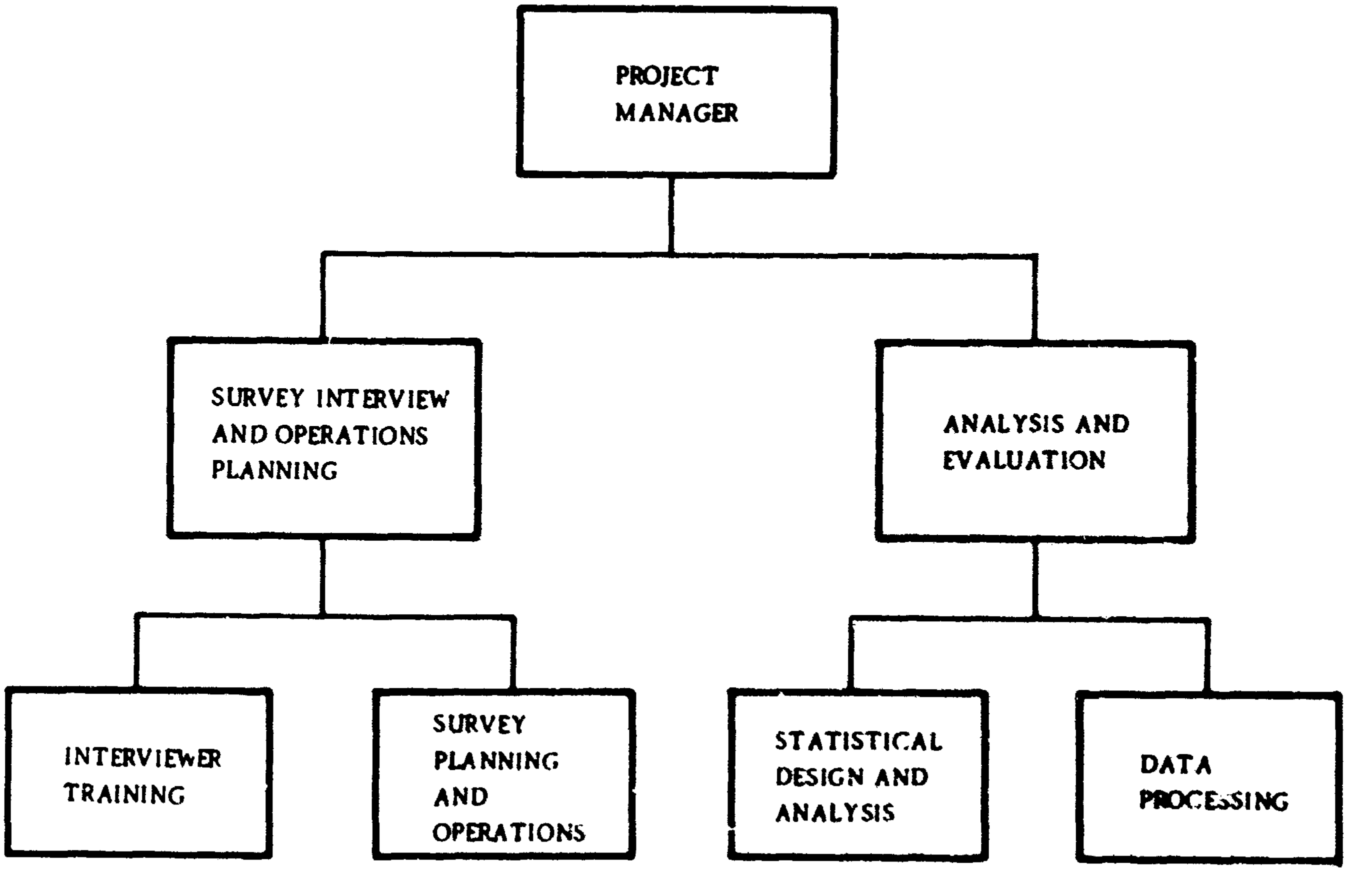

Figure 3-1. Project Organization

Interviewers were selected on the basis of their scientific and technical backgrounds, research experience, interviewing and survey experience, and their maturity, personality, and responsibility. Final selection of interviewers was made by the senior project staff based on performance during training and practice interviews. The selected staff of interviewers was composed of eight behavioral scientists, three operation research analysts, and three information processing specialists. The background and experience of interviewers is summarized in Table 3-1.

Training Program

A two week training program was developed and conducted to indoctrinate interviewers in all aspects of the survey. A total of 20 individuals participated in the training program; from this pool, a group of 14 active and reserve interviewers was selected.

The training program combined both classroom instruction and controlled field practice. Table 3-2 shows the training program schedule; Table 3-3 shows the lesson plan outline. The Interview Guide Handbook served as the basic text for the training. Training included sessions on Program Orientation, Scientific and Technical Information Storage and Retrieval Systems, Survey Operations, Review of Phase I results, a comprehensive study of the Interview Guide, a review of the Analysis Plan, an interview demonstration and a briefing of interview procedures. One day was devoted to practice interviews under the personal supervision of senior personnel who evaluated interviewer performance. On the basis of this practical experience, appropriate remedial sessions were scheduled. In addition, there were four days of practice interviews under supervision of the project staff.

The interview-trainees also visited the Los Angeles facility of the Defense Documentation Center (DDC) and received a comprehensive briefing on its functions and operations.

Training emphasized interview and survey techniques and standardization of interview methods over a highly diversified sample population. Uniform methods of conducting interviews and recording data were covered and the need for self-reliance and initiative on the part of the interviewer was stressed so he could carry interviews to a successful conclusion. A major reference text used was Interviewing: Its Forms and Functions[1]. Other documents utilized during the training sessions are shown in Table 3-4.

Because interviewer bias can affect the manner in which he asks the questions, his impression of the respondent, and his method of recording responses, a key topic in the training program was consideration of factors influencing bias and how to overcome the effects of bias. The training also covered methods of survey operations, setting up interviews, recording responses, processing completed Guides, semiweekly reporting, and handling cancellations and substitutions without compromising the integrity of the sample.

At the end of the training period, a brief examination was administered to assess the interviewers' understanding and comprehension of concepts and the technical

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[1] Richardson, S. A., et al, - Interviewing, Its Forms and Functions, Basic Books, Inc., New York, 1965

Table 3-1. Interviewer Background and Experience

Job Title and Activities	Education	Interview Experience
Research Specialist Research and development in man-computer relations and human performance evaluation	BA-Psychology	Industry Survey of Displays and Controls Applicable to Information Systems Post-Field Test Interviews for Project Cloud Gap (ACDA) Market Research Interviews Job Analysis Interviews Mobility and Job Changes in Engineering (Survey) Interview and Debriefing of Air Defense Personnel
Senior Engineer Computing - Design and development of information systems	MA-Business	Survey of Program Scheduling for SAGE Field Sites Public Opinion Surveys Interview Supervisor - Market Research Interviewing
Research Specialist - Research in library automation and structural linguistics	Ph. D. -English	Survey of Scientific and Technical Information Requirements of FAA (User Needs Survey - Management Level Personnel). Interviewing for Linguistic Atlas of the U. S. and Canada Interviewing for Linguistic Atlas of the Western States
Research Specialist Statistical Analysis, development of information systems	MA-Business	Educational Associates Foundation's Survey

Table 3-1. Interviewer Background and Experience (Cont)

Job Title and Activities	Education	Interview Experience
Research Engineer - Programmed instuction, human factors in information systems	BA-Psychology	Center for Programmed Instruction - User-Needs, Reaction Interviewing Opinion and Market Research Interviewing for Psychology Corporation
Research Engineer - Human Factors Analysis	MA-Psychology	Pre- and Post-Experimental Debriefings and Interviews for NAA Human Factor Studies Depth Interviews for Resident Study to determine Personality Structure/Characteristics of Medical Personnel Interviews to determine welfare qualifications, compliance and Foster Home Placement V.A. Patient and Relative of Deceased Interviews
Research Engineer-Research in human factors; man-system interactions	BA-Psychology	Industry Survey of Displays and Controls Applicable to Information Systems Job Analysis Interviewing Demography Technique Survey-California Transportation Study Customer-need Interviewing Underwood-Olivetti Civilian Criminal/Investigation Interviewing (Pinkerton) Security Interviewing-USAF
Senior Research Engineer-Aerospace engineering and psychology applications	MA-Educational Psychology	Depth Interviews of Human Factors Study subjects, e.g., Pre- and Post-Study Interviews of Apollo Confinement Study subjects and Manned Orbital Research Laboratory Study Subjects Personal Counseling - USC

Table 3-1. Interviewer Background and Experience (Cont)

Job Title and Activities	Education	Interview Experience
Operations Research Analyst - Research in limited and unconventional warfare; information systems	MA-Social Sciences	Student Interview and Counseling, History Instructor-Pepperdine College Interview and Debriefing of CG-3 Personnel Interviews in Connection with Staff & Feature writer on West Point Magazine, "Pointer"
Research Specialist - Operations research, system engineering, user requirements	MA-Psychology	Job Analysis Interviewing-U.S. Civil Service Consumer Market Analyses Interviewing-Ernst Dichter Associates Equipment User Analysis Interviews-General Dynamics Interview and Debriefings - Project Cloud Gap (ACDA) Counseling in Private Practice Rorschach Test Administration
Research Engineer - Research in human performance capabilities of space systems, selection and evaluation of experimental subjects	MA-Psychology	Psychological Counselor and Interviewer with American Institute of Family Relations Subject Pre- and Post-Experimental Interviews-NAA Confinement Studies Customer Need Interviewing - Davis-Rozak Engineering Corporation

Table 3-1. Interviewer Background and Experience (Cont)

Job Title and Activities	Education	Interview Experience
Senior Research Engineer - Programmed instruction, research in human factors in information systems	MS-Education AB-Business	Interview of Manager/Supervisory Personnel to determine Management and Employee Training Needs Attitude Survey of Supervisor/Employee Job Relationship Personnel Interviews on Application of Self-Instructional Techniques in California Elementary School Systems Job Analysis Interviewing Selection, Counseling and Placement Interviewing
Senior Research Engineer - Systems analysis for application of psychological and human engineering techniques	BA-Psychology	Interviews in conjunction with Evaluation of Programmed Performance Aids Survey and Analysis - Hound Dog Project Titan I Personnel Subsystem Test & Evaluation Program for Martin-Denver Counseling Interviews - University of Denver
Senior Engineer Computing - Design and development of information systems	MA-Business	Market Research Interviewing

Table 3-2. Training Program

Day	Class	Hours
1	Program orientation	1
	Scientific and technical information storage and retrieval	2
	Tour of DDC Los Angeles Field Service Center of briefing	2
	Survey operations	2
2	Review of other User Needs Studies	1
	Interview methods and techniques	3
	Review of Phase I Results	2
	Discussion - Interview Guide - Phase II	1
	Summary of the Analysis Plan	1
3	Discussion - Interview Guide	2
	Interview demonstration and discussion of interview procedure	3
	Administration, travel policies, and procedures	1
4	Practice interviews under supervision	8
5	Debriefing, summation, and evaluation	8
6-9	Supervised interviews	8
10	Debriefing, review of Interview Guide and procedures, examination	8

Table 3-3. Lesson Plan Outline

1. Program Orientation
    - A. Study objectives
    - B. Technical information problem in Industry, Government and DOD
    - C. Information retrieval problems
    - D. Study techniques - Interview, sampling, analysis
2. Scientific and Technical Information Requirements in Industry
    - A. Characteristics of scientific and technical information
    - B. Data storage (including indexing and abstracting)
    - C. Data retrieval
    - D. Industry (non-DOD) dissemination
    - E. Technical information centers
3. Organization
    - A. Types of organizations to be surveyed
    - B. Structure of typical organizations (industry, education, nonprofit)
    - C. Job classifications and categories
4. User Requirements (based on Phase I results)
    - A. Review of Phase I results and experience
    - B. Area of interest
    - C. Time (availability)
    - D. Abstract or detail
5. Survey Organization Administration
    - A. Survey control and procedures
    - B. Data analysis
    - C. Schedules, travel requirements, reporting requirements
6. Survey - Interviewing Techniques and Data Collection
    - A. Survey - Interview techniques
    - B. Study method
    - C. Interview Guide - Detailed study and analysis of Interview Guide
    - D. Interview questions
    - E. Strategy of interviewing
    - F. Data recording and coding
7. Interview Demonstration - Debriefing
8. Data Recording/Coding Practice
9. Interview Practice - Student/instructor and student/student
10. Interview Practice - Debriefing

Table 3-3. Lesson Plan Outline (Cont)

11.	Interview practice - Intra-company sample of engineers and scientists; observations by instructors and other students
12.	Interview practice - Debriefing
13.	Coding practice test - To assure student understanding of interview; jargon and relationships
14.	Interview practice - Intra-company sample (with observations)
15.	Interview practice - Debriefing and summation of study objectives and techniques
16.	Evaluation and final selection of interviewers

Table 3-4. Technical Material Distributed to Trainees

Organization/Document
North American Aviation, Inc. - Proposal for DOD User-Needs Study
DOD User-Needs Study - Final Report - Phase I, Part 1
Interview Guide Handbook, SID 65-1041-1, 26 July 65
Interview Guide SID 65-1041-2, 26 July 65
Interview Reference Manual, SID 65-1041-3, 26 July 65
Synopsis of Interview Topics, SID 65-1041-4, 26 July 65
Scientific Information Agencies, of Federal Agencies NSF 64-13
Distribution Guide, DDC Reprint, Jan. 65
Cosati Subject Category List, AD-612-200
DDC Digest No. 5, Oct. 64 - DOD Information Analysis Centers
DDC Services, June 65
DDC Information Brochure, Oct. 64
TAB (sample copy - to be carried by interviewer)
STAR (sample copy - to be carried by interviewer)
Description of NAA Technical Information Center and System, GO-APS-2
Purpose and Functions of Electronic Properties Information Center, Hughes Aircraft
Samples of DDC - ASTIA Document Cover Pages

terminology of the study. The results of this quiz were quite gratifying: there was an average of only one error per trainee. Appropriate corrective discussions were held where required.

The scheduled debriefings and discussions at the end of the training period proved extremely valuable in clarifying all aspects of the conduct of interviews. For example; some of the aspects covered were: (1) the avoidance of classified or proprietary data; (2) the importance of the initial introduction in identifying the task and obtaining as many information "chunks" as possible; (3) the avoidance of leading the interviewee in his phrasing of questions; (4) the mechanics of recording responses; (5) the sharpening of differences between information source and medium by using examples; and (6) the ability to describe and explain the functions and services rendered by DDC, and other awareness services and selective dissemination services.

Since the initial survey interviews were conducted at North American Aviation, Inc. (NAA), it was possible to supervise interviewers and to improve their performance.

3.2 SURVEY PLANNING AND OPERATIONS

Sample Selection

With the cooperation of the National Security Industrial Association, DOD obtained voluntary participation from 83 industrial organizations, research institutions, and universities with defense contracts. The Office of the Director of Defense Research and Engineering (ODDR&E) provided explicit instructions on the method to be employed by each organization in selecting the sample of individuals to

be interviewed. This procedure was contained in a letter from that office to the participating companies (Appendix 7). Upon being advised that a company agreed to participate, NAA forwarded these instructions to the company, together with the request to appoint a survey coordinator and to provide alternates in case the initially selected interviewee was not available.

DOD provided the initial sample of companies to be surveyed and NAA provided extensive support in obtaining the necessary sample. This was accomplished by vigorous follow-up action with the various organizations originally contacted by DOD, and by arranging for additional qualifying organizations in the defense industry not originally contacted to provide individuals to be interviewed. The participating organizations and the total number of interviewees they provided are shown in Appendix 1.

Planning and Scheduling

It was apparent from the outset that careful control, planning, and scheduling of survey operations was an essential prerequisite to the successful conduct of this study. In addition, the data being collected in the field had to be monitored to insure its quality, so that the conclusions reached in the study would be meaningful and valid.

A basic constraint on survey planning was the contractual requirement that all interviews be completed by 31 December 1965. NAA planned survey operations to conclude by 1 December to avoid conducting interviews during the holiday season. Also, to avoid weather problems and consequent interference with the tightly programmed interview operations, schedules were planned so as to complete all interviews east of the Mississippi prior to the onset of winter. Further, to maintain the morale of the interviewers, and hence to maintain the high quality of interviews, trips for interviewers were, wherever possible, limited to three weeks.

To insure smooth survey operation, appropriate procedures were developed and controls established. Schedules were prepared sufficiently in advance to give each participating organization at least two weeks advance notice of the scheduled interviews. This allowed adequate time for necessary arrangements and schedule modifications, if required. All interview arrangements were processed through a survey coordinator designated by each company. The coordinator was responsible for arranging specific schedules in accordance with the NAA survey plan and providing alternates in case the primary interviewee could not be available. Making alternates available was extremely important to the efficient conduct of the survey in that it minimized time lost by NAA interviewers, avoided subsequent costly rescheduling, and ensured that the required sample was obtained. Since all arrangements were made and verified well in advance of the arrival of the interviewer at each location, few difficulties or delays were experienced during the survey. In addition, all required visit clearance requests were processed in accordance with established industrial security procedures.

Interviews were normally scheduled at the rate of three per day, except when precluded by distance between interview locations. This number of daily interviews was considered optimal, and was based on the experience obtained in Phase I and the pilot test.

Trips were planned so as to minimize travel time and costs per interview. Normally, all the interviews for a particular region were completed during one trip (eg., New York City and the surrounding area, the New England area, the

Pacific Northwest, etc.). Appendix 10 shows a typical travel plan. Interviewers were rotated back to Downey every two to three weeks, and given local area interviews. This allowed for the required periodic debriefings and avoided undue family hardship. Every effort was made to match interviewers with interviewees, on the basis of technical area and scientific discipline.

Survey Control

Survey controls encompassed interview control, correspondence with participating companies, follow-up, and interview quality control. Each participating company was assigned a control number and, upon completion, each interview was assigned an accession number to aid in maintaining control, accounting, and for subsequent analysis. Figure 3-2 depicts the flow of survey operations.

Upon receipt of names from a participating company, a letter of acknowledgement was sent (Figure 3-3). When the detailed schedule was prepared, a letter of transmittal (Figure 3-4) and an Interview-Schedule (Form ADM 390) was completed (Figure 3-5); a separate schedule was made for each location if several sites were involved. Also, an individual letter of notification was prepared for each interviewee (Figure 3-6). Two to three weeks prior to the interviews, the following items were sent to the company coordinator: (1) Letter of Transmittal (Figure 3-4), (2) Interview Schedule (Figure 3-5); and (3) Individual Notification (Figure 3-6) and (4) Synopsis of Interview (Appendix 8).

The company coordinator distributed the Notification and Synopsis to each individual, and notified the NAA Control Office of any changes in schedule, substitution of alternate interviewees, and any appropriate administrative matters.

In preparing for and conducting the interviews, each interviewer followed established administrative, operating, and reporting procedures (see Appendix 9). Weekly status reports to DOD were required and were prepared on the basis of either telephone or written reports submitted by interviewers. (Figure 3-7).

Synopsis of Interview

Early in the planning of survey operations, the senior project staff determined that the conduct of the survey and quality of responses would be enhanced considerably if interviewees were familiar with both the purpose of the study and the type of questions to be asked. Consequently, a descriptive brochure, "Synopsis of Interview Topics," was developed for distribution to each interviewee in advance of the interview.

This brochure acquainted the interviewee with the topics to be discussed. It provided a frame of reference, described the gist of the subject matter, and served to ease possible anxiety or concern. Also, the synopsis served to reassure management that the survey was intended to explore information needs and utilization patterns and was not an attempt to obtain classified or proprietary information. This brochure was an extremely useful tool in the survey operation and contributed to high quality interviews. Feedback from interviewers indicated that the synopsis fulfilled its intended purposes.

3.3 DATA COLLECTION AND EDITING

Data collected in this survey comprised two basic types: operations data and interview data.

Operations Data

The data that pertains to carrying out the survey is called operations data and can be used in planning any future interview surveys. An item of interest is the duration of the interview for the 1500 interviewees. The average, minimum, and maximum time taken to interview each interviewee were respectively 96, 45 and 210 minutes. In order to show the effects of learning on the part of the interviewer, the time phase change of the average time of interview is plotted in Figure 3-8. This is what one would expect as part of the normal learning process by the interviewers. The number of interviews conducted and the population from which the interviews were sampled are shown in Appendix 1.

Interview Data Control and Editing

The key aspect of the interviewing function is the recording and reporting of responses.

The quality of the data analysis depends to a great extent on the quality of the data collected during the interviews. Therefore, appropriate procedures were developed and implemented to ensure that a consistently high quality of data was obtained and to provide accurate and complete input for computer analysis.

Quality control extended from the interview itself to keypunching of data and subsequent analysis. The control procedures cover such aspects as interview control to ensure that all scheduled interviews are accounted for, periodic reporting, and detailed review and edit of each Interview Guide. For the edit and control procedures see Appendix 11. The overall system flow is that shown in Figure 3-2.

In this study, the interview responses were recorded in both precoded and narrative-subjective form. To minimize errors or omissions, each interviewer was required to review and inspect the material from each interview (the Interview Guide) immediately after its completion and before he preceded to the next interview.

To reduce errors in transcribing data from the interview guide to punched cards, the interview guides were designed to accept the data in boxes numbered according to their position(s) on the punched card. Further, all completed interviews were sent to the project control office within a week of the interview for review and preliminary edit. In the early stage of this study, notice of recurring errors by one or more interviewers was transmitted immediately to those interviewers for remedial action. This reduced significantly the number of errors committed throughout the remainder of the study.

The project control office examined the answers to see that related questions did not have contradictory answers. These contradictions could generally be resolved by checking the interviewee's notes in the comment pages. Where contradictions or omissions could not be resolved, they were referred to the interviewer upon his return to the NAA facility.

Upon the return of the interviewers from their first out-of-town trip, they were thoroughly debriefed to determine administrative or technical problems for which corrective action might be required. Also, as a continuing training technique, upon completing the first increment of interviews, each interviewer edited approximately 20 Interview Guides prepared by another interviewer. Debriefings, at a lesser scale, were done through the remainder of the survey.

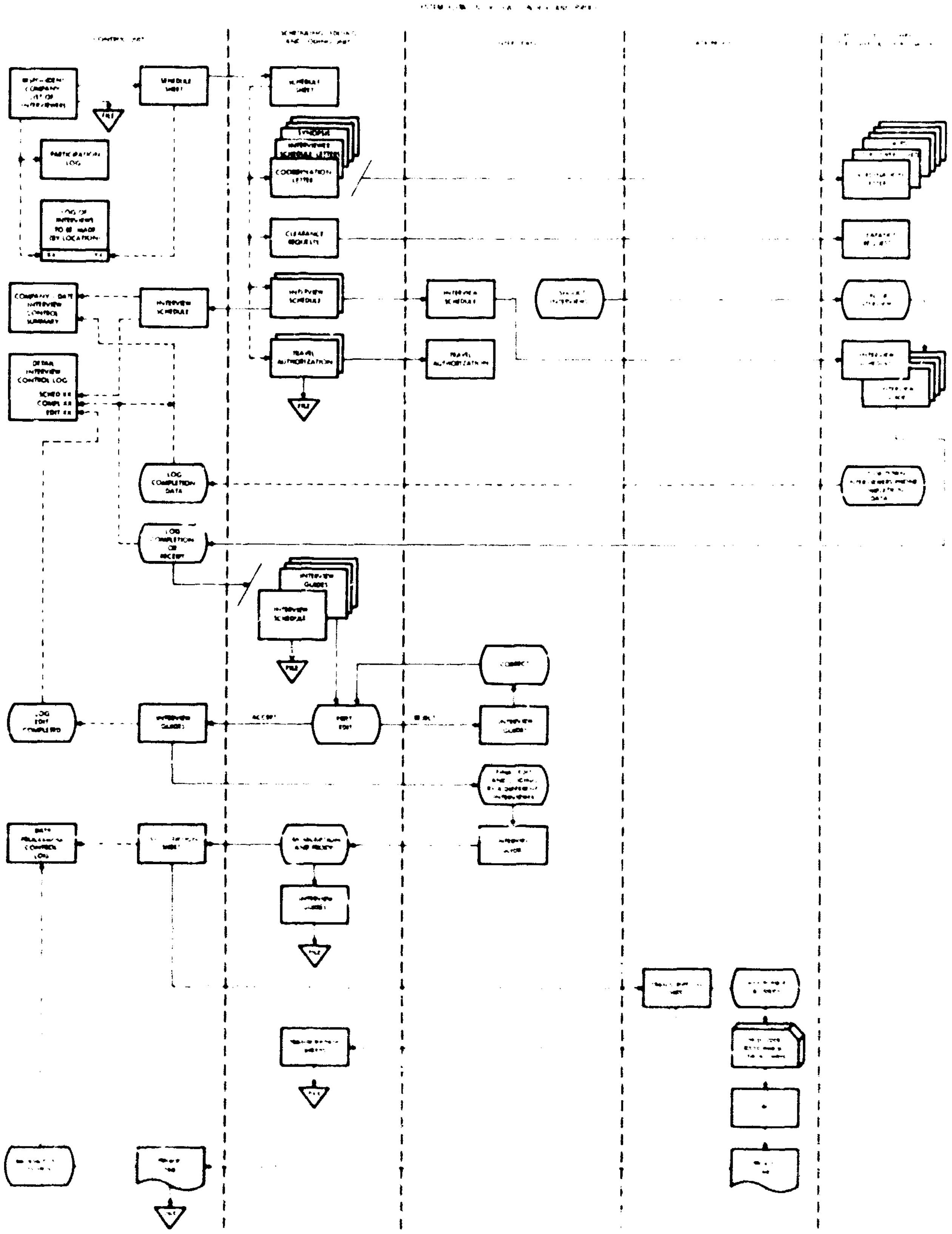
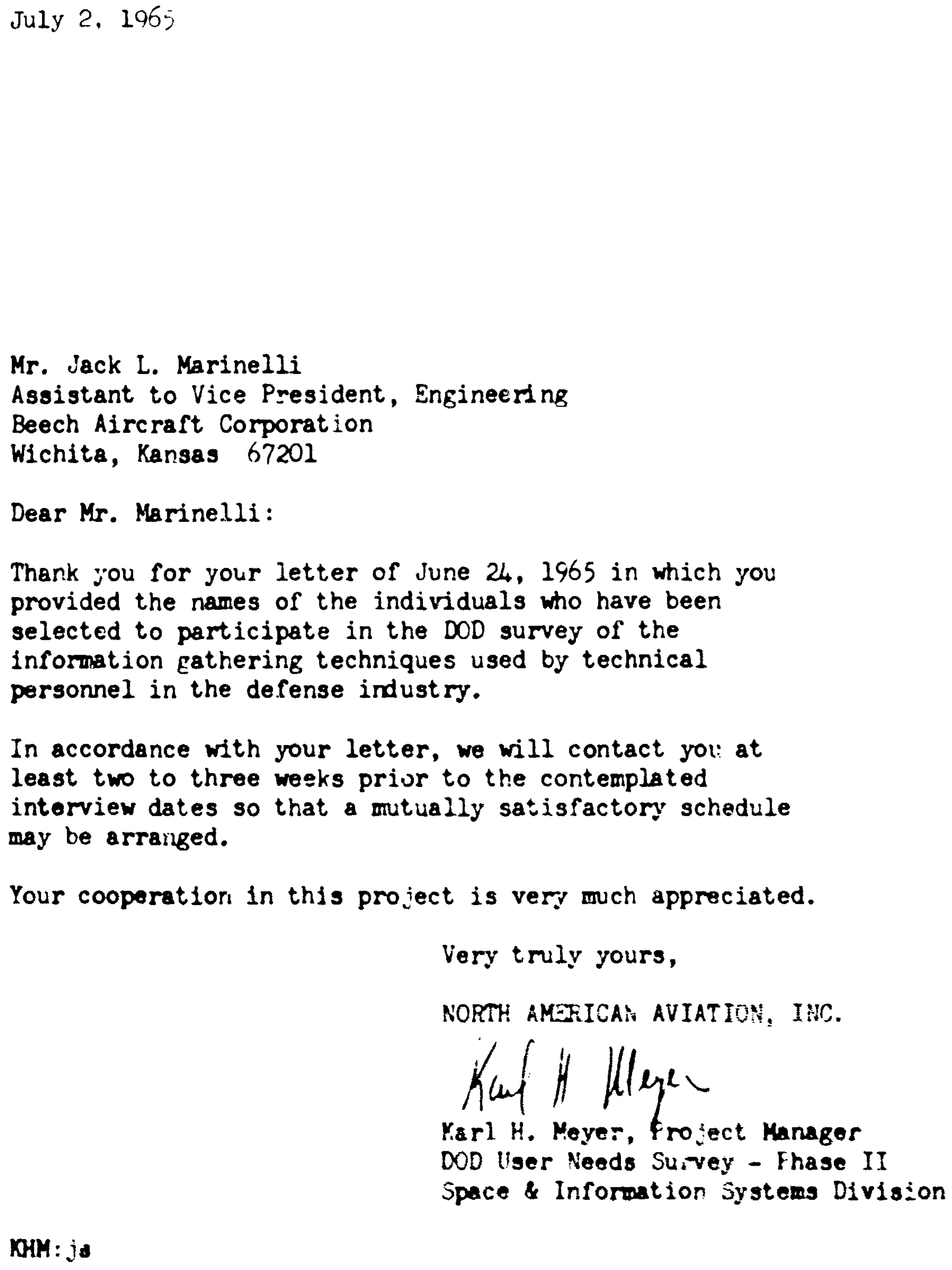


Figure 3-2. System Flow - Interview Control and Processing



July 2, 1965

Mr. Jack L. Marinelli
Assistant to Vice President, Engineering
Beech Aircraft Corporation
Wichita, Kansas 67201

Dear Mr. Marinelli:

Thank you for your letter of June 24, 1965 in which you provided the names of the individuals who have been selected to participate in the DOD survey of the information gathering techniques used by technical personnel in the defense industry.

In accordance with your letter, we will contact you at least two to three weeks prior to the contemplated interview dates so that a mutually satisfactory schedule may be arranged.

Your cooperation in this project is very much appreciated.

Very truly yours,

NORTH AMERICAN AVIATION, INC.

Karl H Meyer

Karl H. Meyer, Project Manager
DOD User Needs Survey - Phase II
Space & Information Systems Division

KHM:ja

Figure 3-3. Letter of Acknowledgement

July 29, 1965

Mr. Jack L. Marinelli
Assistant to Vice President, Engineering
Beech Aircraft Corporation
Wichita, Kansas 67201

Dear Mr. Marinelli:

This is in answer to your letter dated June 24, 1965, which provides the names of your people to be interviewed for the DOD User Needs Survey.

In order to utilize most effectively the time allowed for this study, we have scheduled the selected participants under your cognizance for interviews for particular dates and times.

Enclosed is the schedule of all interviews plus the notification for each interviewee to be distributed by you to each of them. Your interviewer is Mr. H. H. Terzagian who will contact you upon arrival in your area. In those cases where selected individuals cannot be interviewed as scheduled, it is requested that you switch appointments among those already selected. If this is not possible, please select an alternate at random from those not previously selected from the original list. If circumstances require that this schedule be changed in any way, I would appreciate your notifying my office as soon as possible. You can reach me or my assistant, Sol Pollack, by calling collect at area code 213, phone 923-8111, extensions 4505, 1063 or 4066.

Your cooperation in this matter is greatly appreciated.

Sincerely yours,

NORTH AMERICAN AVIATION, INC.

Karl H. Meyer

Karl H. Meyer, Project Manager
DOD User Needs Survey - Phase II
Space & Information Systems Division

KHM:co

Enclosures: 1. Interview Schedule
2. Individual Notifications (including synopsis of survey topics)

Figure 3-4. Letter of Transmittal

DOD USER NEEDS SURVEY, PHASE II -

INTERVIEW SCHEDULE

COMPANY I.D. 007

COMPANY NAME Beech Aircraft Corporation

PHONE MUrray 3-4681

LOCATION Wichita, Kansas

CITY STATE

COMPANY CONTACT Jack L. Marinelli

PHONE MUrray 3-4681

INTERVIEWER I.D. 85

INTERVIEWER NAME H. H. Terzagian

INTERVIEW SCHEDULE

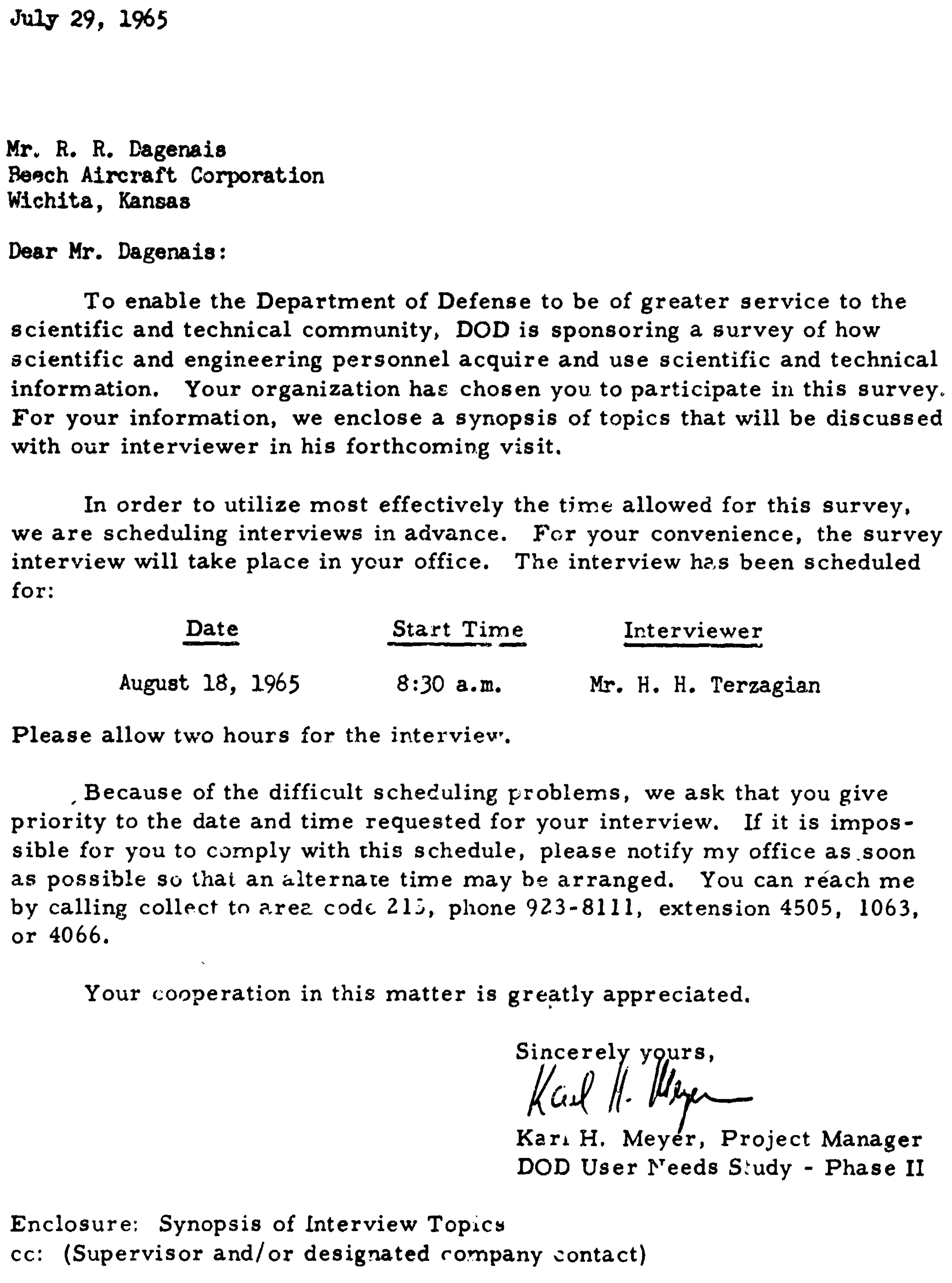
I.I.D.	INTERVIEWEE NAME	PHONE EXT.	INTERVIEW INFORMATION			
			SCHEDULED		COMPLETION	
			DATE	TIME	DATE	ELAPSED TIME
	R. R. [illegible]genais	683-4681 8116	8-13-65	8:30 a.m.		
	R. R. McIlwain	329	8-18-65	11:00 a.m.		
	P. S. Weniger	8193	8-18-65	3:00 p.m.		
	R. C. Hervey	469	8-19-65	8:30 a.m.		
	M. F. Scott	1486	8-19-65	11:00 a.m.		

TEMP FORM ADM-390 EXPIRES 8-24-65

REMARKS

CODES - CANCELLED INTERVIEW
1. SICK
2. INTERVIEWEE ON TRAVEL STATUS
3. VACATION
4. TERMINATED EMPLOYMENT
5. NOT ELIGIBLE AS PART OF SAMPLE
9. OTHER

Figure 3-5. Interview Schedule



July 29, 1965

Mr. R. R. Dagenais
Beech Aircraft Corporation
Wichita, Kansas

Dear Mr. Dagenais:

To enable the Department of Defense to be of greater service to the scientific and technical community, DOD is sponsoring a survey of how scientific and engineering personnel acquire and use scientific and technical information. Your organization has chosen you to participate in this survey. For your information, we enclose a synopsis of topics that will be discussed with our interviewer in his forthcoming visit.

In order to utilize most effectively the time allowed for this survey, we are scheduling interviews in advance. For your convenience, the survey interview will take place in your office. The interview has been scheduled for:

Date	Start Time	Interviewer
August 18, 1965	8:30 a.m.	Mr. H. H. Terzagian

Please allow two hours for the interview.

Because of the difficult scheduling problems, we ask that you give priority to the date and time requested for your interview. If it is impossible for you to comply with this schedule, please notify my office as soon as possible so that an alternate time may be arranged. You can reach me by calling collect to area code 213, phone 923-8111, extension 4505, 1063, or 4066.

Your cooperation in this matter is greatly appreciated.

Sincerely yours,
Karl H. Meyer
Karl H. Meyer, Project Manager
DOD User Needs Study - Phase II

Enclosure: Synopsis of Interview Topics
cc: (Supervisor and/or designated company contact)

Figure 3-6. Notification to Interviewee

WEEKLY REPORT

Interview Operations - Week 15

DOD User-Needs Survey - Phase II

During the week of November 8 - November 12, 1965, 65 interviews were scheduled of which 64 were completed. The 64 were all qualified.

The average time per interview was 92 minutes with averages for each interviewer ranging from 81 minutes to 100 minutes. During this week, the following companies were completed:

U.S. Steel Corporation
Raytheon Manufacturing Co.
IBM Federal Systems Div.

The cumulative totals for the fifteen weeks of interview operations are: 1264 interviews were scheduled of which eleven were cancelled. Of the 1253 completed, 8 were not qualified. The average time for the 1245 qualified interviews was 96 minutes.

During the week Lear-Siegler furnished an added 9 names of individuals to be interviewed. As of November 12, 1965, the sample population was 77 companies and 1393 interviews.

AVCO Research Laboratories, Institute of Defense Analysis, Systems Development Corporation, University of Southern California, and MIT Instrumentation Labs. are expected to submit their interviewee lists to us next week. These companies are expected to develop about 140 more interviewees.

Figure 3-7. Weekly Report

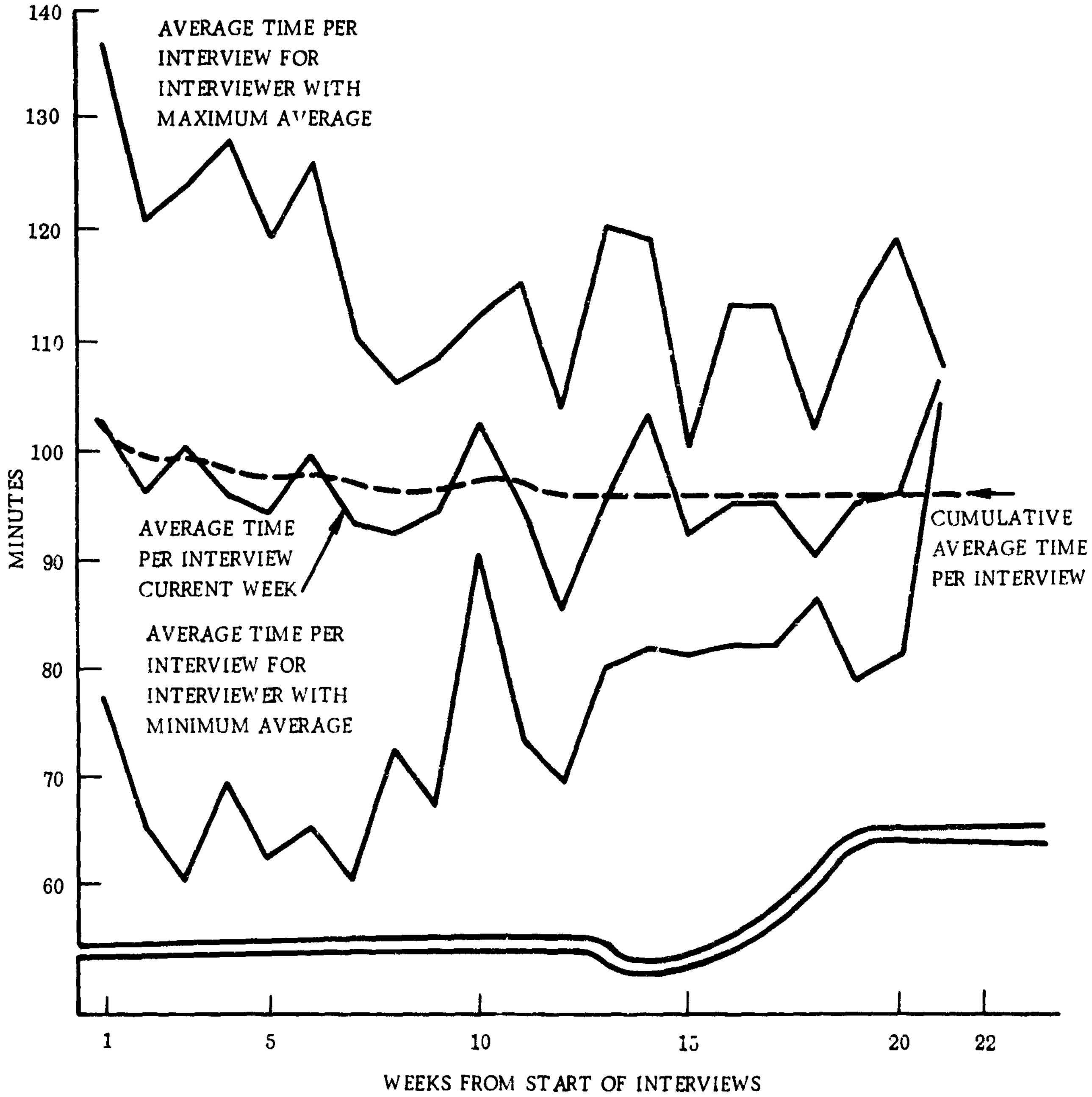


Figure 3-8. Average Time Per Interview

4. ANALYSIS

4.1 INTRODUCTION

Requirements of the Analysis

An overview of the analysis is presented in Section 1. This section, however, describes the analysis and its motivation in considerably more breadth and depth.

An analysis ought to operate upon the data in such a way, and to such an extent, that the analytical requirements are met. What an analysis ought to accomplish is determined by both the data and the analytical requirements. The weaker the data or the stronger the analytical requirements, the stronger should an analysis be.

An analysis should provide a bridge between the data, and meaningful guidelines for management decisions and recommendations for the future. It should bring the information content of the data into focus. It should transform apparent chaos into orderly conclusions.

In order to achieve this, an analysis must organize, summarize and interpret the data. The methods of summarization employed by an analysis ought to be sufficient to bring both the detailed and general information content of the data into focus. Higher-order effects are indicated by detailed information, whereas lower-order effects are indicated by general information.

Detailed information is relatively close to the surface of the data and requires a relatively small amount of summarization to be brought into focus. The more the detail, the less the summarization required. On the other hand, general information is buried relatively far beneath the surface of the data and requires a relatively large amount of summarization to be brought into focus. The more the generality, the more the summarization required.

The survey data consist of the reports of 1500 interviews, each containing the answers to 63 questions which represent component parts of the flow process. Of these 63 questions, 55 have qualitative responses and 8 have quantitative responses.

By its very nature, detailed information describing only small portions of the flow process may be comprehended at once. General information describing either small or large portions of the flow process, however, may be comprehended at once. That is, only small amounts of great detail may be simultaneously digested; whereas, either small or large amounts of little detail may be simultaneously digested.

Consequently, the analysis first should summarize the data until their detailed information content, describing only small portions of the flow process at once, is brought into comprehensible focus. It then should continue to summarize the data until their general information content, describing both small and large portions of the flow process at once, is brought into comprehensible focus. Otherwise, management will be forced to accept only the data's detailed information content, or to itself perform additional summarization so that the data's general information content is brought into comprehensible focus.

Frequency Distributions

A one-way frequency distribution is the distribution of the percent of answers to a question that corresponds to each question response, and a two-way frequency distribution is the distribution of the percent of answers to a pair of questions that corresponds to each pair of question responses (See Table 4-1). Higher-order frequency distributions are similarly defined. Frequency distributions necessitate the simplest operation upon the data, and contain a wealth of detailed information regarding variation in the data; but they provide the minimal amount of summarization.

The usual procedures for summarizing a one-way frequency distribution are to combine some question responses, and to obtain measures of the one-way frequency distribution's location and spread. The distribution's location may be measured by its mode if the qualitative question responses are not arranged into an order, by its median if the qualitative question responses are ordered, and by its mean if the question responses are quantitative. Measures of the distribution's spread are its range if the qualitative question responses are ordered, and its standard deviation if the question responses are quantitative. More definitive information is obtained by this summarization, when the qualitative question responses are ordered; and even more definitive information is obtained, when the question responses are quantitative.

Summarization of two-way frequency distributions is both more necessary and more difficult to perform. The first step is to combine some responses for each question, and/or to obtain measures of the location and dispersion of each question's one-way frequency distribution. Then a measure of the association or interaction between the two questions is sought. If the qualitative responses to each question are ordered, the interaction between the two questions may be measured by the rank correlation (coefficient); and if each question's responses are quantitative, the interaction may be measured by the correlation (coefficient). An indirect approach to measuring this interaction, when the question responses are qualitative, is provided by Chi-square, which indicates the departure of the questions from being independent or not related.

Computation of the rank correlation automatically associates the numbers 1, 2, ... with the first, second, ... responses to each question. On the other hand, the computation of the correlation depends upon the quantitative responses to each question, or the numbers associated with the responses to each question.

As for one-way frequency distributions, more definitive information is obtained by this summarization when the qualitative question responses are ordered; and even more definitive information is obtained when the question responses are quantitative. Arrangement of qualitative question responses into an informative order is called development of a detailed structure, while association of a number with each ordered qualitative question response is called definition of a numerical description for the detailed structure. The development of a detailed structure followed by the definition of a numerical description for the detailed structure transforms the qualitative question responses into numerical form.

Higher-order frequency distributions become increasingly harder to generate, depict and comprehend. Consequently, their summarization becomes both increasingly more necessary and more difficult. They are of relatively little analytical use, except in rare instances.

Table 4-1. One-Way and Two-Way Frequency Distributions

ONE-WAY FREQUENCY DISTRIBUTION

Question 22: Desired Volume of Information Media

Response	Frequency (%)
All from Recall	7
One Report or Document	30
A Sampling of the Reports and Documents Available	22
All Reports and Documents That Could be Found Pertinent to the Question	41

TWO-WAY FREQUENCY DISTRIBUTION

Question 25: Desired Depth of Information Media

Question 22: Desired Volume of Information Media		RESPONSE		
		A Once Over Lightly	A Specific Answer	A Detailed Analysis
RESPONSE	All from Recall	0%	5%	2%
	One Report or Document	2%	18%	10%
	A Sampling of the Reports and Documents Available	3%	10%	9%
	All Reports and Documents That Could Be Found Pertinent to the Question	2%	23%	16%

Relationships

For questions with quantitative responses, a relationship among questions is a mathematical expression of the variation in one question as a function of the variations in the other questions. It is frequently both convenient and sufficiently accurate (e.g., during exploratory research such as Phase II) to represent a relationship by a linear model, which depicts the variation in one question as a linear combination of the variations in the other questions. The linear model is written

$$Y = \beta_0 + \beta_1 X_1 + \cdots + \beta_p X_p + \epsilon ,$$

with Y being one question, $X_1, X_2, \cdots, X_p$ being the other questions, $\beta_0, \beta_1, \cdots, \beta_p$ being the unspecified constants or coefficients, and ϵ being the residual. The correlation, in reality, measures the degree of linearity for the interaction between the two questions, or the closeness of the two questions to being adequately represented by a linear model,

$$Y = \beta_0 + \beta_1 X + \epsilon ,$$

for the relationship between one question Y and the other question X.

The analysis of relationships requires not only quantitative data, but also models for the relationships among questions. In turn, the construction of models for these relationships requires that the questions be arranged into an informative and unifying order. Arrangement of questions into an informative and unifying order is called development of a general structure. The development of a general structure followed by the specification of models for relationships among questions in the general structure accomplishes the model construction. Consequently, the analysis of relationships depends upon both the transformation of qualitative question responses into numerical form, and the construction of models for relationships among questions.

Comparison

Two-way frequency distributions are easy to generate, and their concept is easy to understand. They summarize relatively little, however, and their information content is difficult to comprehend without additional summarization. On the other hand, relationships are not as easy to obtain and to understand in concept; but they do summarize a great deal, and their information content is easy to comprehend without additional summarization.

Let the responses to one question be associated with the X-axis and the responses to the other question be associated with the Y-axis. Then a two-way frequency distribution may be viewed as a geometric representation for the distribution of the answers to the two questions, in which each percentage gives the proportion of answer pairs which are associated with the corresponding response-pair point. In addition a linear model of the relationship,

$$Y = \beta_0 + \beta_1 X + \epsilon ,$$

may be viewed as a natural summarization of the two-way frequency distribution. It replaces the geometric representation of the distribution with a line through it, and with an analytic representation of the distribution and the line. The more the

distribution tends to cluster closely around a line, the more appropriate is a linear model for the relationship; and the higher is the correlation between the two questions. Figure 4-1 presents an example, using the two-way frequency distribution from Table 4-1 (for which a linear model is not very appropriate).

Although two-way frequency distributions may be summarized to present some general information regarding the interaction of the two questions, they are limited to describing only small portions of the flow process at once. Relationships, however, are not limited at all and may be used to describe either small or large portions of the flow process. In addition relationships sufficiently summarize the data, via an analytic representation, to bring its general information content into focus. They provide a natural summarization of not only two-way, but also higher-order, frequency distributions.

For a detailed analysis of the data, two-way frequency distributions are necessary. Analysis of relationships is required for a general analysis of the data, and the construction of a process model for such purposes as the design of future experiments and the computer simulation of the process. In addition, relationships provide a global view of large portions of the flow process, which enables many small portions of the process to be examined simultaneously and their relative importance evaluated.

The analysis of relationships has many advantages over the generation of two-way frequency distributions. One must, however, realize that these advantages have to be paid for by the transformation of qualitative question responses into numerical form, and the construction of models for relationships among questions. In addition, the relationship results should be analyzed and interpreted via techniques which are relatively insensitive to changes in the transformation.

Objectives of the Analysis

The summarization of data to bring into focus their detailed information content, describing small portions of the flow process, could be achieved by means of one-way and two-way frequency distributions for single questions and pairs of questions. An analysis of relationships among questions could accomplish the additional summarization of the data to bring into focus their general information content, describing both small and large portions of the flow process.

Qualitative question responses, however, pose a problem. Although frequency distributions may be generated for qualitative question responses, they provide much more definitive information for quantitative question responses. Analysis of relationships, as noted above, requires both the transformation of qualitative question responses into numerical form, and the construction of models for relationships among questions.

Thus, the objectives of the analysis are to:

- Generate one-way and two-way frequency distributions for single questions and pairs of questions in the Interview Guide.
- Transform the qualitative question responses into numerical form.

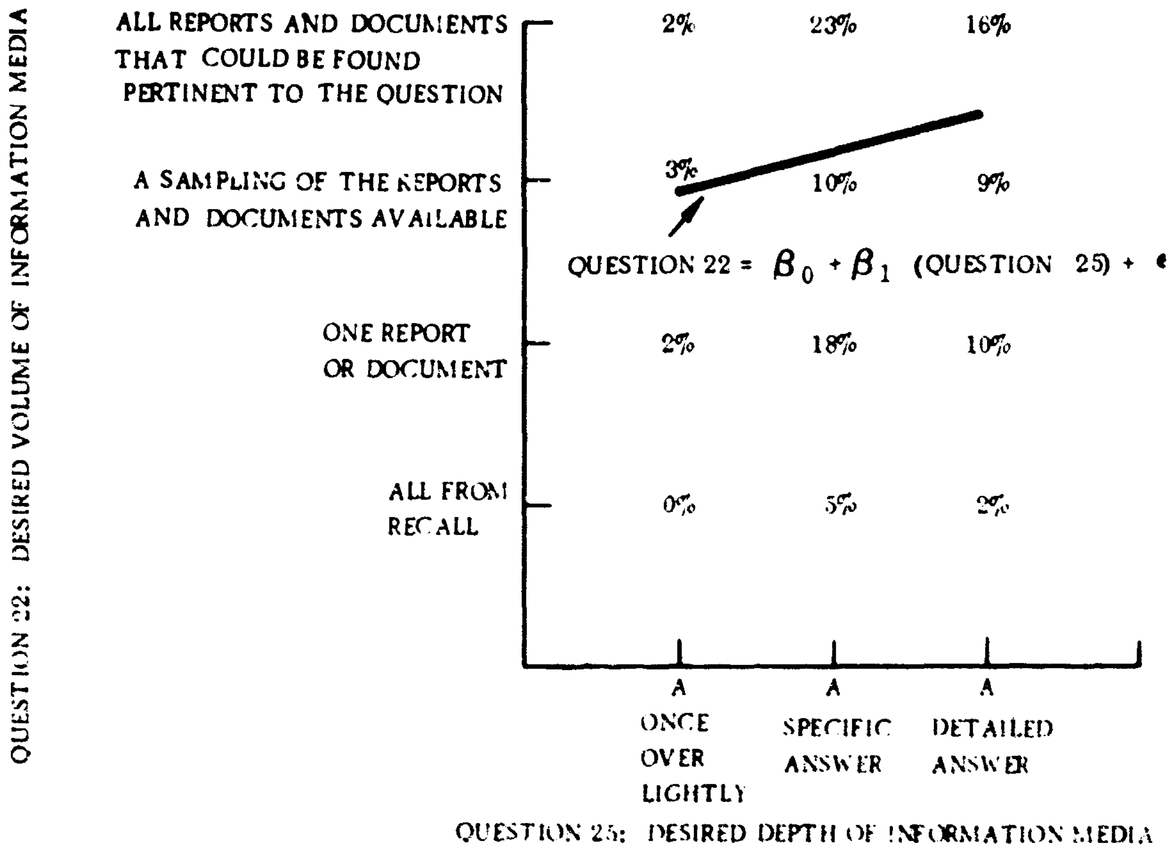


Figure 4-1. Representation of a Two-Way Frequency Distribution

- Construct and estimate models for relationships among questions in the Interview Guide.

- Analyze and interpret the frequency distribution and relationship results, in order to provide meaningful guidelines for management decisions and recommendations for the future which are relatively insensitive to changes in the transformation.

Overview of the Analysis

Detailed information describing small portions of the flow process is provided by one-way and two-way frequency distributions.

In addition, the relationship analysis cycle yields general information describing both small and large portions of the flow process.

The relationship analysis cycle transforms the qualitative question responses into numerical form, constructs and estimates models for relationships among questions, and then transforms the numerical relationship results back to qualitative form (see Figure 4-2). As illustrated by Table 4-2, the transformation of qualitative question responses into numerical form is accomplished in two steps:

- A detailed structure is developed by grouping the related responses to a question and arranging these groups (and, to the extent possible, the responses within groups) into an informative order. (See Appendix 12.) The grouping and arranging are based on the primary unifying characteristic of the question's responses, as determined from the responses themselves and the intent of the question.

- A numerical description of the detailed structure is defined by associating a number with each ordered question response. The base point for a numerical scale is selected, according to the primary unifying characteristic of the question. With each response there is then associated a numerical value, corresponding to its relative "distance" from the base point, along a scale from -1 to 1 (usually from 0 to 1).

Next the construction and estimation of models for relationships among questions are performed in the following four steps:

- Groups of related questions are arranged into an informative and unifying order to form a general structure. (See Appendix 13). To the extent feasible, the arrangement possesses the desirable characteristic that a question tends to influence only those questions which follow it. An example is contained in Table 4-3.

- Pairs of related questions are combined as illustrated in Table 4-3, in order to simplify the specification and estimation of models for relationships among questions in the general structure. Except for rare cases in which a product is employed, all of the combinations of related questions are averages of the numbers previously assigned. The scales remain between -1 and 1 (usually between 0 and 1), in all cases.

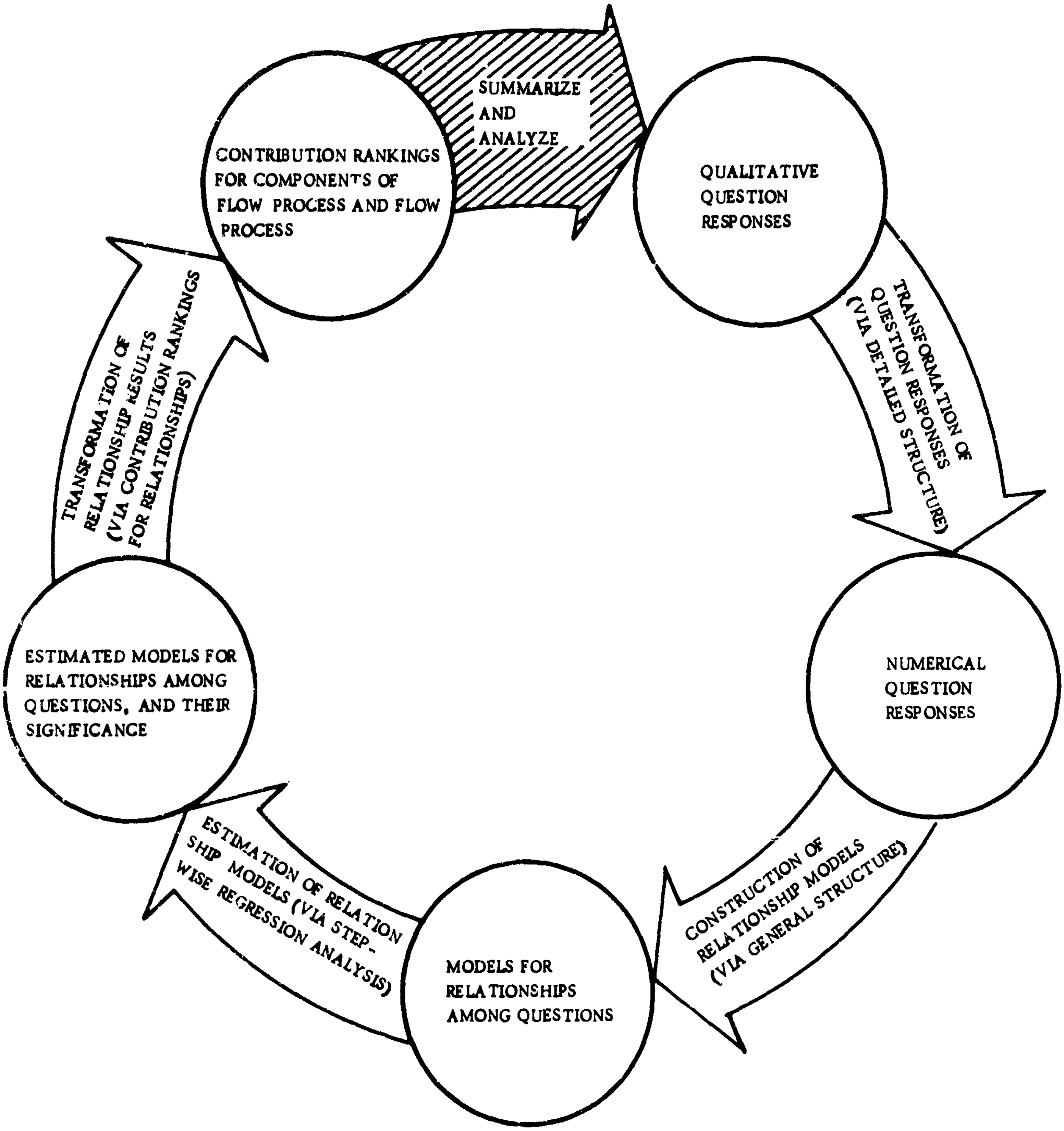


Figure 4-2. Relationship Analysis Cycle

Table 4-2. Transformation of Qualitative Question Responses into Numerical Form

Question 14: Location of First Source for Information

Informative Order[A]		Scale
I	Received with task assignment	0
II	Recalled it	0.05
III	Searched own collection	0.10
VI	Respondent's own action	0.15
V	Assigned subordinate to get it	0.20
VI	Asked a colleague	0.25
VII	Asked my supervisor	0.30
VIII	Requested search of department files	0.35
IX	Asked an internal company consultant	0.45
X	Searched company information center [B]	0.50
X	Requested library search	0.50
XI	Requested data from vendor, manufacturer, supplier [B]	0.60
XI	Searched vendor, manufacturer, supplier sources	0.60
XII	Searched outside library	0.70
XIII	Asked an external consultant or expert	0.80
XIV	Requested search of DOD Information Center [B]	0.90
XIV	Searched DOD Information Center	0.90
XV	Asked customer	1.00

A. It is instructive to note the evolution of the responses and their order:

1. The 12 responses to Question 40 in the Phase I Interview Guide were reordered and expanded into the 16 responses to Question 14 in the Phase II Interview Guide.
2. Then the 16 responses were expanded to 18, based on an analysis of the answers to the response, "other - specify."
3. Finally the 18 responses were arranged into an informative order, according to their primary characteristic, which may be called "distance from the user."

B. No distinction is made between the two responses in this group of related responses.

Table 4-3. Arrangement and Combination of Questions

USER COMPONENT

A. User's Age: Question 48

B. User's Education

1. User's Highest Degree: Question 50A
2. User's Field of Degree: Question 50C
3. User's Year of Degree: Question 50B

C. User's Experience

1. User's Job Experience: Question 51
2. User's Company Experience: Question 52

Combination of Questions: 1/2 (Question 51 + Question 52)

D. User's Position

1. User's Kind of Position: Question 55
2. User's Field of Position: Question 56

E. User's Level

1. User's Equivalent Government Service (GS) Rating: Question 58
2. Number of Personnel Supervised by User: Question 49
3. User's Type of Activity: Question 54

Combination of Questions: 1/2 (Question 49 + Question 58)

- Linear models are specified to represent potential relationships among combinations of questions in the general structure. (See Table 4-4). The models are defined in general form to include unspecified constants which, when evaluated, completely determine the model.

- Unspecified constants in the general form of the models are estimated from the data by the technique of regression analysis. Regression analysis also indicates the significance of a relationship and the relative contribution of question combinations to the relationship. (See Table 4-4).

Finally, the numerical relationship results are transformed back to qualitative form by a ranking procedure which:

- Ranks question combinations in order of their contribution to each relationship, as shown in Table 4-4.
- Ranks question combinations in order of their overall contribution to the relationships in each component of the flow process and the flow process itself, as illustrated by Table 4-5.

The relationship analysis cycle is believed to be novel in the field of information science. Its employment and testing in Phase II have yielded results that are encouraging, and implications for the future that are provocative.

Analysis and interpretation of the above results produce meaningful guidelines for management decisions and recommendations for the future which are relatively insensitive to changes in the detailed structure and its numerical description. In addition, a comparison is made between the comparable one-way and two-way frequency distributions from Phases I and II; and the Phase I conclusions are reviewed in the light of the Phase II data.

4.2 FREQUENCY DISTRIBUTIONS

A one-way frequency distribution has been generated for 59 of the 63 questions in the Interview Guide. The remaining four questions were narrative and were not categorized.

From the large number of two-way frequency distributions that could have been generated, 196 were selected for compilation. These were supplemented by the analysis of relationships and the complete correlation matrix, which was a by-product of that analysis.

One-way frequency distributions were transcribed from the marginal distribution of the appropriate two-way frequency distributions. The computer program employed to generate two-way frequency distributions was BMD 08D (see Appendix 15 and Reference 5).

Volume III contains all of these one-way and two-way frequency distributions, and the complete correlation matrix. They are summarized in Appendices 12 and 14 and analyzed in Section 5.

4.3 TRANSFORMATION OF QUESTION RESPONSES

As noted above, the transformation of qualitative question responses into numerical form is performed by the development of a detailed structure and the definition of a numerical description for that detailed structure.

Development of a Detailed Structure

A detailed structure for the responses to questions in the Interview Guide is developed to serve as the basis for the transformation of question responses. In addition, the detailed structure brings the local aspects of the flow process into focus and provides a foundation for a general structure. This detailed structure is formed by the informative arrangement of question responses.

User Characteristic	Judged Potentially Related To	Related To[A]	Candidate For Relationship[F]
User's highest degree (Q50A)	User'age age (Q48)		
User's field of degree (Q50C)	User's age	User's age[B, C]	User's highest degree[G]
User's experience (1/2(Q51+Q52))	User's age	User's age[D, E]	User's highest degree
User's kind of position (Q55)	User's age, highest degree, field of degree and experience	User's highest degree[B, D]	
User's field of position (Q56)	User's age, highest degree, field of degree, and experience	User's field of degree,[D] highest degree,[B] and age[B]	User's kind of position
User's level (1/2(Q49+Q58))	User's age, highest degree, field of degree, experience, kind of position, and field of position	User's highest degree,[D] experience,[C] age,[C] and field of position[B, F]	

A. Are ranked in order of contribution to the relationship
B. Coefficient is negative (all other coefficients being positive).
C. Makes a significant contribution to the relationship.
D. Makes a highly significant contribution to the relationship.
E. Relationship is significant.
F. Are ranked in order of potential contribution to the relationship.
G. Would potentially make a significant contribution to the relationship.

Table 4-4. USER Relationships

Table 4-5. USER Ranks*

Related Question Combinations / Combination of Questions	User's Age (Q48)	User's Highest Degree (Q50A)	User's Field of Degree (Q50C)	User's Experience (1/2(Q51+Q52))	User's Kind of Position (Q55)	User's Field of Position (Q56)	User's Level (1/2(Q49 + Q58))
User's Highest Degree (Q50A)		0					
User's Field of Degree (Q50C)	1	2	0				
User's Experience (1/2(Q51+Q52))	1	2		0			
User's Kind of Position (Q55)		1			0		
User's Field of Position (Q56)	3	2	1		4	0	
User's Level (1/2(Q49+Q58))	3	1		2		4	0
Question Combination Column Total	32	8	49	50	52	52	60
Question Combination Rank	2	1	3	4	5-1/2	5-1/2	7

*Table entries are assigned, according to order of appearance in Table 1-4, as follows: 0 to combination of questions in CHARACTERISTIC column: 1 to 1st question combination, 2 to 2nd question combination, . . . , m to last question combination in RELATED TO column; m+1 to 1st question combination, m+2 to 2nd question combination, . . . , p ≤11 to last question combination in CANDIDATE FOR RELATIONSHIP column; and 12, which is omitted for simplicity, to those question combinations not appearing.

The first step is to specify the primary unifying characteristic of each question's responses. This response characteristic should be determined from not only the responses themselves, but also the question's intent.

The next step is to collect into groups those question responses which are related by the response characteristic. According to this characteristic, an ordering is then arranged for groups and, to the extent possible, for responses within groups. All responses to a question may be arranged into one ordering if all responses within each group may be arranged into an ordering. A response (or a group of responses) is more similar, according to the response characteristic, to responses (or groups of responses) which are closer to it in the arrangement, than it is to those which are farther away.

Depending upon the implications of the response characteristic, there are three types of detailed structure:

- Visible structure, which is explicitly implied by the response characteristic.
- Partially visible structure, which is implicitly implied by the response characteristic.
- Invisible structure, which is not implied at all by the response characteristic.

A visible structure is obvious and possesses no flexibility; a partially visible structure is apparent, but possesses some flexibility; while an invisible structure must be inferred and possesses considerable flexibility. The position of responses in the arrangement is meaningful in a visible structure, indicative in a partially visible structure, but only descriptive in an invisible structure.

Examples of visible, partially visible and invisible structures are given in Tables 4-6 through 4-8, respectively. For the tables, Arabic numerals in parentheses (i.e., (1), (2), · · ·) indicate the ordering in the Interview Guide; while Roman numerals (i.e., I, II, · · ·) indicate the ordering in the detailed structure. The numerical description scale is included in the tables.

Appendix 12 contains the detailed structure. For the reader's convenience, the corresponding numerical description scales and one-way frequency distributions are also presented.

Definition of a Numerical Description

Once the detailed structure is developed, its numerical description is appropriate. By associating a number with each question response, the numerical description provides a more exact differentiation among question responses; and it enables estimation of the linear models which are constructed for relationships among questions. The numerical description also represents the data in a form to which a large variety of numerical techniques may be applied.

According to the response characteristic, the base point or zero for a numerical scale is selected. There is then associated with each response, a numerical valve corresponding to its relative "distance" from the base point.

Table 4-6. Visible Structure

Question 58: User's Equivalent GS Rating

		Informative Order	Scale
I.	(01)	GS-6 (under 6,000)	0.07
II.	(02)	GS-9 (6,000 - 7,999)	0.15
III.	(03)	GS-11 (8,000 - 10,249)	0.23
IV.	(04)	GS-12 (10,250 - 11,999)	0.30
V.	(05)	GS-13 (12,000 - 13,999)	0.39
VI.	(06)	GS-14 (14,000 - 16,499)	0.46
VII.	(07)	GS-15 (16,500 - 18,999)	0.54
VIII.	(08)	GS-16 (19,000 - 20, 999)	0.60
IX.	(09)	GS-17 (21,000 - 23,999)	0.70
X.	(10)	GS-18 (24,000 - 26,999)	0.76
XI.	(11)	Sp A (27,000 - 29,999)	0.85
XII.	(12)	Sp B (30,000 - 34,999)	0.92
XIII.	(13)	Sp C (over 35,000)	1.00

Except for two questions, a -1, 0, or positive integer (i.e., 1, 2, ...) is associated with each question response. The two exceptional questions have multiples of 1/2 associated with some responses, for convenience. A 0 is employed when it is meaningful to consider the response to be null, and -1 is employed when it is meaningful to consider the response to be in the opposite direction to the remaining responses. Variable spacing between the associated numbers indicates that the responses exhibit variable similarity, or distance from each other, according to the response characteristic. The same number is associated with two responses to a question if, and only if, the two responses are in the same group of related responses, and the responses within that group cannot be arranged into an ordering (i.e., are the same distance from the base point).

The association of a number with each question response associates a scale of possible numerical values with the question. Then all numerical values in the scale are divided by the largest one, so that the scale is normalized to between -1 and 1, and usually between 0 and 1.

The value of the numerical description is meaningful for responses in a visible structure, indicative for responses in a partially visible structure, but only

Table 4-7. Partially Visible Structure

Question 14: First Source for Information

	Informative Order	Scale
I	Received with task assignment	0
II	Recalled it	0.05
III	Searched own collection	0.10
IV	Respondent's own action	0.15
V	Assigned subordinate to get it	0.20
VI	Asked a colleague	0.25
VII	Asked my supervisor	0.30
VIII	Requested search of department files	0.35
IX	Asked an internal company consultant	0.45
X	Searched company information center	0.50
X	Requested library search	0.50
XI	Requested data from vendor, manufacturer, supplier	0.60
XI	Searched vendor, manufacturer, supplier sources	0.60
XII	Searched outside library	0.70
XIII	Asked an external consultant or expert	0.80
XIV	Requested search of DOD Information Center	0.90
XIV	Searched DOD Information Center	0.90
XV	Asked customer	1.00

descriptive for responses in an invisible structure. Examples are again provided by Tables 4-6 through 4-8.

A detailed structure suggests its own numerical description when the question responses have been properly arranged. For a more refined relationship analysis, a numerical description could be altered to improve the linearity of important relationships which involve the corresponding question.

See Appendix 12 for the numerical description of the detailed structure.

4.4 CONSTRUCTION AND ESTIMATION OF RELATIONSHIP MODELS

Development of a general structure, combination of pairs of related questions in the general structure, and specification of linear models for relationships among combinations of questions in the general structure accomplish the construction of relationship models. Then these relationship models are estimated.

Table 4-8. Invisible Structure

Question 27: Desired Layout of Information Media

		Informative Order	Scale
I.	(14)	Recall	0.00
II.	(13)	Telephone conversation	0.06
III.	(11)	Group discussion	0.12
IV.	(4)	Photographs	0.19
V.	(3)	Graphics (diagrams, drawings, schematics, flow charts, graphs, maps)	0.25
VI.	(2)	Tables or lists	0.31
VII.	(1)	Narrative text	0.37
VIII.	(18)	Narrative text and tables or lists	0.44
IX.	(9)	Graphics and lists	0.50
X.	(8)	Photographs and text	0.56
XI.	(7)	Graphics and text	0.63
XII.	(16)	Graphics, text and oral	0.69
XIII.	(17)	Graphics, text, oral, and recall	0.75
XIV.	(12)	Informal briefing, with chalk or pencil drawings	0.82
XV.	(5)	Microfilm - microfiche	0.88
XVI.	(6)	Slides or motion pictures	0.94
XVII.	(10)	Formal briefing or lecture	1.00

Development of a General Structure

In order to serve as the basis for the construction of models for relationships among questions and to bring the global aspects of the flow process into focus, a general structure is now developed. This general structure is formed by the informative and unifying arrangement of questions.

The first step is to identify the major components or profiles of the flow process (as represented by the Interview Guide). They are the USER, TASK, UTILIZATION, and SEARCH AND ACQUISITION components. The USER and TASK components characterize the user and his most recent scientific or technical task, respectively. His general utilization of information centers and services is described by the UTILIZATION component. Properties of the user's search for, and acquisition of, information specifically related to the task compose the SEARCH AND ACQUISITION component. The next step is to classify each question into one of these components and to form groups of related questions within components. Then an ordering is arranged for components, groups within components and questions within groups. To the extent feasible, the arrangement should possess the desirable characteristic that a question tend to influence only those questions which follow it.

An example is provided by Table 4-9, which also includes question combinations and linear models for relationships. In this table, Q denotes Question; and $\beta_0, \beta_1, \beta_2, \ldots, \beta_6$ symbolize general unspecified constants in the models. For simplicity, the same symbols, $\beta_0, \beta_1, \beta_2, \ldots, \beta_6$, are used in each model; although they are not meant to denote the same constants.

Questions (components) which tend to influence other questions (components) are called input questions (components), and those which tend to be influenced by other questions (components) are called output questions (components). Arrangement of components and questions within components according to an input/output point of view facilitates the specification of models for relationships. In addition, it provides insight into the flow process.

The general structure, with question combinations and estimated linear models for relationships, appears in Appendix 13.

Combination of Related Questions

Pairs of related questions are combined to simplify the specification and estimation of models for relationships among questions in the general structure. In addition, the combination of related questions summarizes and simplifies the general structure.

Question combinations which tend to influence other combinations of questions are called input factors, and combinations of questions which tend to be influenced by other question combinations are called output factors.

Except for the four cases in which a product is employed, all of the combinations are averages. This keeps the combination scales normalized to between -1 and 1. For example, see Table 4-9.

A special user-task flexibility index F summarizes the flexibility exhibited by the difference between the user's kind of position and the kind of his task, and that between the user's field of position and the field of his task. In order to summarize the effort expended by the user in his general utilization of information centers and services and the problems encountered by him in this utilization, the respective special indices, E for utilization effort and P for utilization problems, are introduced. The inadequacy of the process of searching for, and acquiring, specific task information is summarized by the special index I for inadequacy of the search and acquisition process. The scales for F, E, P, and I are also normalized to between -1 and 1.

Table 4-9. Specification of Relationship Models

USER COMPONENT*

A. User's Age: Q48

B. User's Education:

1. User's Highest Degree: $Q50A = \beta_0 + \beta_1(Q48)$
2. Field of Degree: $Q50C = \beta_0 + \beta_1(Q48)$
3. Year of Degree (Q50B)

   Used only for one-way and two-way frequency distributions

C. Experience of User

Combination: $\frac{1}{2}(Q51+Q52) = \beta_0 + \beta_1(Q48)$

1. Job Experience: Q51
2. Company Experience: Q52

D. Position of User

1. Kind of Activity:

   $Q55 = \beta_0 + \beta_1(Q48) + \beta_2(Q50A) + \beta_3(Q50C) + \beta_4(\frac{1}{2}(Q51+Q52))$

2. Field of Activity:

   $Q56 = \beta_0 + \beta_1(Q48) + \beta_2(Q50A) + \beta_3(Q50C) + \beta_4(\frac{1}{2}(Q51+Q52))$

3. MOS Equivalent (Q53 and Q57 - narrative - coded as Q57)

   Used only for one-way and two-way frequency distributions

E. Level of User

Combination:

$$\frac{1}{2}(Q49+Q58) = \beta_0 + \beta_1(Q48) + \beta_2(Q50A) + \beta_3(Q50C) + \beta_4(\frac{1}{2}(Q51+Q52) + \beta_5(Q55) + \beta_6(Q56)$$

1. Equivalent GS Rating: Q58
2. Personnel Supervised: Q49
3. Type of Activity (Q54)

   Used only for one-way and two-way frequency distributions

*Q denotes Question; and $\beta_0, \beta_1, \beta_2, \ldots, \beta_6$ symbolize general unspecified constants in the models. For simplicity, the same symbols. $\beta_0, \beta_1, \beta_2, \ldots, \beta_6$ are used for each model; although they are not meant to denote the same constants.

When a more refined analysis of relationships is desired, the question combinations could be separated; and more special summarizing indices could perhaps be defined.

All question combinations are given in Appendix 13.

Specification of Relationship Models

Once the general structure is developed and pairs of related questions are combined, it is appropriate to specify linear models for relationships among combinations of questions in the general structure. The terms, combination of questions and question combination, also are used to cover the degenerate case of a single question (e.g., Q56 in Table 4-9). A linear model of a relationship among question combinations is a mathematical expression of the variation in a given combination of questions (Y) as a linear function, with unspecified constants, of the variations in the other question combinations (X_1, X_2, ..., X_p).

The term, combination of questions, will be used for the given combination of questions (Y); and the term, question combination, will be used for the other combinations of questions (X_1, X_2, ..., X_p).

Analysis of the general structure from an input/output point of view yields those question combinations which are judged to be potentially related to each combination of questions in the general structure. Only the potentially related question combinations are included in the linear model of the relationship for that combination of questions. An example is provided by Table 4-9.

When the questions have been properly arranged, a general structure suggests the linear models for relationships. A more refined relationship analysis could specify additional models, particularly those necessitated by the separation of question combinations and those suggested by the relationship results of Section 6.

The potentially related question combinations, in the linear model for each combination of questions in the general structure, are given in Tables 6-1 through 6-5 of Section 6. In addition the corresponding estimated linear models, with estimated values of the unspecified constants or coefficients, are contained in Appendix 13.

Estimation of Relationship Models

The linear models, which have been constructed for relationships among combinations of questions, are estimated from the qualitative question responses which have been transformed into numerical form via a stepwise regression analysis. For a complete description of this technique, Reference 6 should be consulted. A brief discussion of only the pertinent aspects of stepwise regression analysis follows.

Stepwise regression analysis estimates the relationship model in steps by entering one question combination at a time. At each step, the question combination which is entered is the one that adds the greatest contribution to the relationship from the previous step. A measure of this contribution is the F to enter of this question combination at that step. The contribution of each question combination to the relationship at that step is measured by its F to remove at that step; and the significance of the relationship at that step is measured by the multiple correlation (coefficient) at that step. Relative significance within a relationship is indicated by the former, while

relative significance among relationships is indicated by the latter. In addition the potential contribution to the relationship at this step of some question combinations which were not included in the relationship model is measured by their potential F to enter at this step.

The computer program employed for the stepwise regression analysis is BMD 02R (see Appendix 15 and Reference 5). Stepwise regression computer printouts appear in Volume III, are summarized in Appendix 13, and are analyzed in Section 6.

4.5 TRANSFORMATION OF RELATIONSHIP RESULTS

The stepwise regression computer printouts contain a wealth of numerical detail concerning relationship results and their significance. In order to make the conclusions of the relationship analysis relatively insensitive to the transformation of qualitative question responses into numerical form, the numerical relationship results must be transformed back to qualitative form. The numerical detail also has to be summarized considerably if the relationship conclusions are to be easily comprehended.

Both of these requirements are accomplished via a ranking procedure which:

- Ranks question combinations in order of their contribution to each relationship (see Table 4-10).
- Then ranks question combinations in order of their overall contribution to the relationships in each component of the flow process and the flow process itself (see Table 4-11).

The former focuses upon a given combination of questions, and observes which question combinations are most significantly related to it; while the latter focuses upon the appropriate collection of combinations of questions, and observes which question combinations are most significantly related to them most often.

Contribution Ranking for the Relationships

An effective step in the stepwise regression analysis, beyond which relatively little is contributed to the relationship, is determined when the F to enter, of the question combination entering at that step, becomes less than some lower bound. Analysis of the stepwise regression computer printouts indicates that a reasonable value for this lower bound is 6.66 (F level of .01). When a question combination is included in the relationship at the effective step, it is said to be related to the given combination of questions.

A question combination appears to make a significant contribution to the relationship when its F to remove at that step is between 30 and 90 ($30 \leq F$ to remove < 90), and appears to make a highly significant contribution to the relationship when its F to remove at that step is at or above 90 (F to remove ≥ 90). If the multiple correlation at the effective step is at or above .40 in absolute value, then the relationship is called significant. Those question combinations, whose potential F to enter at this step is at or above 6.66, are said to be candidates for the relationship; and those, whose potential F to enter at this step is at or above 30, are said to potentially make a significant contribution to the relationship.

User Characteristic	Judged Potentially Related To	Related To[A]	Candidate For Relationship[F]
User's highest degree (Q50A)	User'age age (Q48)		
User's field of degree (Q50C)	User's age	User's age[B, C]	User's highest degree[G]
User's experience (1/2(Q51+Q52))	User's age	User's age[D, F]	User's highest degree
User's kind of position (Q55)	User's age, highest degree, field of degree and experience	User's highest degree[B, D]	
User's field of position (Q56)	User's age, highest degree, field of degree, and experience	User's field of degree,[D] highest degree,[B] and age[B]	User's kind of position
User's level (1/2(Q49+Q58))	User's age, highest degree, field of degree, experience, kind of position, and field of position	User's highest degree,[D] experience,[C] age,[C] and field of position[B, F]	

A. Are ranked in order of contribution to the relationship

B. Coefficient is negative (all other coefficients being positive).

C. Makes a significant contribution to the relationship.

D. Makes a highly significant contribution to the relationship.

E. Relationship is significant.

F. Are ranked in order of potential contribution to the relationship.

G. Would potentially make a significant contribution to the relationship.

Table 4-10. USER Relationships

Table 4-11. USER Ranks*

Related Question Combinations / Combination of Questions	User's Age (Q48)	User's Highest Degree (Q50A)	User's Field of Degree (Q50C)	User's Experience (1/2(Q51+Q52))	User's Kind of Position (Q55)	User's Field of Position (Q56)	User's Level (1/2(Q49 + Q58))
User's Highest Degree (Q50A)		0					
User's Field of Degree (Q50C)	1	2	0				
User's Experience (1/2(Q51+Q52))	1	2		0			
User's Kind of Position (Q55)		1			0		
User's Field of Position (Q56)	3	2	1		4	0	
User's Level (1/2(Q49+Q58))	3	1		2		4	0
Question Combination Column Total	32	8	49	50	52	52	60
Question Combination Rank	2	1	3	4	5-1/2	5-1/2	7

*Table entries are assigned, according to order of appearance in Table 1-4, as follows: 0 to combination of questions in CHARACTERISTIC column: 1 to 1st question combination, 2 to 2nd question combination, . . . , m to last question combination in RELATED TO column; m+1 to 1st question combination, m+2 to 2nd question combination, . . . , p ≤11 to last question combination in CANDIDATE FOR RELATIONSHIP column; and 12, which is omitted for simplicity, to those question combinations not appearing.

For each combination of questions in the general structure, the question combinations which are related to it are ranked in order of their contribution to the relationship (see Table 4-10 and Section 6 for an example). Each question combination's rank and the significance of its contribution to the relationship are listed in Tables 6-1 through 6-5 of Section 6. These tables also include the sign of the question combination's coefficient in the relationship, the significance of the relationship, candidates for the relationship, and the significance of their potential contribution to the relationship. Appendix 13 lists the estimated linear models, with the estimated values of the unspecified constants, at the effective step, and the significance of each question combination's contribution to the relationship.

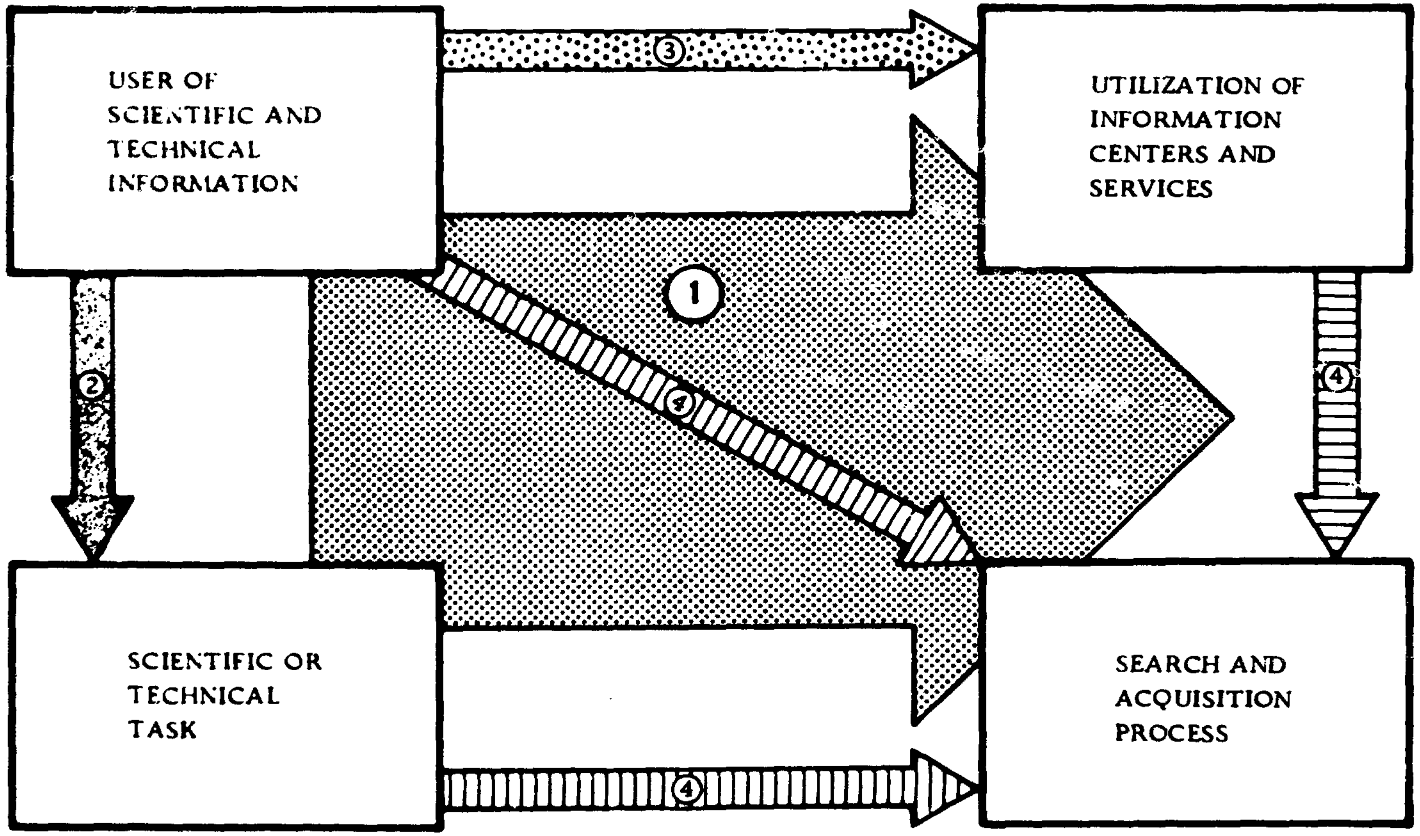
Contribution Ranking for the Components and the Flow Process

These contribution rankings may be obtained by properly combining the contribution rankings for the appropriate collection of relationships. In order to accomplish this, numerical values must be assigned to the relationship rankings. This return to numerical form is, however, an artifice and only temporary.

The procedure assigns a value to a relationship ranking as follows: 0 to the given combination of questions, 1 to the question combination making the largest contribution to the relationship, 2 to the question combination making the second largest contribution to the relationship, ..., m to the question combination making the smallest contribution to the relationship; m+1 to the candidate for the relationship potentially making the largest contribution to the relationship, m+2 to the candidate for the relationship potentially making the 2nd largest contribution to the relationship ..., $p \leq 11$ to the candidate for the relationship potentially making the smallest contribution to the relationship; and 12 to those question combinations which do not appear, although they might have appeared according to the general structure and the input/output view of the flow process. This value was selected because no combination of questions had more than 11 question combinations which were either related to it or candidates for the relationship. An example is presented in Table 4-11 and Section 6.

Now the sum of these numerical values is computed for a question combination over each component, and over their aggregate for the flow process. Then the sums for each component and those for the flow process are ranked among themselves, in order of increasing size. There were only a few ambiguities present in computing these rankings and their sums. They involved questions which occurred in relationship models both alone and in question combinations (i.e., Q14, Q15, Q17, Q37 and Q39). These questions are always associated with the appropriate question combination which contains them. Section 6 contains an example.

It is both informative and suggestive to characterize combinations of questions as input factors and output factors in not only analyzing the flow process, but also designing and analyzing the information system which serves the process (see Figure 4-3). One must realize, however, that regression analysis can merely estimate and indicate the significance of a relationship. It cannot imply that the relationship is cause and effect, for this can only be accomplished by a thorough knowledge of the flow process. Therefore, the terms, input factor and output factor, are used in full recognition of the attendant advantages and disadvantages.



*The arrows point from input (tending to influence) to output (tending to be influenced).

Figure 4-3. Input/Output Relations for the Flow Process*

The numerical values for each relationship ranking, and the contribution rankings for the four components and the flow process appear in Tables 6-6 through 6-9 of Section 6. Important input and output factors are presented in Figures 6-2 through 6-6 of Section 6. An example is provided by Table 4-11.

4.6 COMPARISON OF ONE-WAY FREQUENCY DISTRIBUTIONS

In order to make the comparison of one-way frequency distributions from Phases I and II objective, a measure is needed for the difference between the two one-way frequency distributions. Then the Phase I and Phase II samples can be judged to come from the same population when the value of this measure is sufficiently small; and they can be judged to come from different populations when its value is significantly large. The problem is to select the measure in such a way that one knows when it becomes significantly large.

This is precisely the form of the classical hypothesis-testing problem in statistics. As a matter of fact, it is closely related to the hypothesis-testing problem whose solution is the Chi-square goodness-of-fit test. One, therefore, suspects that a Chi-square-type statistic would provide a good measure for the difference between the two one-way frequency distributions.

Appropriate notation is now introduced. Let the collections of categories for the Phase I and Phase II one-way frequency distributions be so modified (e.g., by combination, deletion, etc.) that the resulting category collections are made identical. Then let m be the resulting number of response categories in both collections, n be the resulting sample size for the Phase I one-way frequency distribution, N be the resulting sample size for the Phase II one-way frequency distribution, f_j be the resulting number of observations in the jth category for the Phase I one-way frequency distribution, and g_j be the resulting number of observations in the jth category for the Phase II one-way frequency distribution. It follows that

$$\sum_{j=1}^{m} f_j = n \text{ and } \sum_{j=1}^{m} g_j = N$$

If the two one-way frequency distributions, $(f_1, f_2, \ldots, f_m)$ and $(g_1, g_2, \ldots, g_m)$, are to be made comparable, $(f_1, f_2, \ldots, f_m)$ has to be adjusted to the sample size N (or vice-versa). Let

$$h_j = (N/n)\, f_j \text{ for } j = 1, 2, \ldots, m$$

Then

$$\sum_{j=1}^{m} h_j = (N/n) \sum_{j=1}^{m} f_j = N$$

The measure employed in the analysis for Section 7 and in the tables of Volume III is the Chi-square-type statistic,

$$J^2 = \frac{1}{2} \sum_{j=1}^{m} \left[(g_j - h_j)^2 / (g_j + h_j) \right]$$

It was conjectured, but never proved, that J^2 might be approximately distributed as Chi-square (χ^2) with m-1 degrees of freedom (df). However, during the preparation of the Final Report, it was discovered (Reference 8, pages 746-8) that

$$\chi^2 = (n+N)\sum_{j=1}^{m} \left\{ \left[f_j - \frac{n(f_j+g_j)}{n+N} \right]^2 / n(f_j+g_j) + \left[g_j - \frac{N(f_j+g_j)}{n+N} \right]^2 / N(f_j+g_j) \right\}$$

$$= (n+N)\sum_{j=1}^{m} \left[\left(\frac{Nf_j-ng_j}{n+N} \right)^2 / n(f_j+g_j) + \left(\frac{ng_j-Nf_j}{n+N} \right)^2 / N(f_j+g_j) \right]$$

$$= (n+N) \sum_{j=1}^{m} \left[(n+N) \quad (ng_j-Nf_j)^2/(n+N)^2 nN(g_j+f_j) \right]$$

$$= \sum_{j=1}^{m} \left[(ng_j-Nf_j)^2/nN(g_j+f_j) \right]$$

$$= \sum_{j=1}^{m} \left\{ \left[g_j-(N/n)f_j \right]^2 /N/n)(g_j+f_j) \right\}$$

$$= \sum_{j=1}^{m} \left\{ (g_j-h_j)^2 / \left[(N/n)g_j+h_j \right] \right\}$$

is approximately distributed as Chi-square with m-1 degrees of freedom. Now χ^2 is approximately twice J^2, since $N/n \approx 1500/1375$ is close to one. Hence, the analysis and tables were modified by using $2J^2$ as if it were χ^2, with some small changes resulting.

5. FREQUENCY DISTRIBUTIONS

5.1 INTRODUCTION

This portion of the Phase II analysis concerns itself with the one-way frequency distributions for the percent of users, tasks, or information units (chunks) that are associated with each response to a question, and the two-way frequency distributions for the percent of users, tasks, or information chunks that are associated with each pair of responses to a pair of questions. In addition to its primary function as a frequency distribution, a two-way frequency distribution also displays the association or interaction between (the answers to) the two questions.

The data has been structured or organized into a logical grouping and ordering of questions (general structure) and of responses for each question (detailed structure). The general structure evolved from the separation of the questions into their four natural areas of description:

- Those questions which describe the USER of scientific and technical information (interviewee).
- Those questions which describe his most recently completed scientific or technical TASK.
- Those questions which describe his general UTILIZATION of information centers and services.
- Those questions which describe the information SEARCH AND ACQUISITION process associated with the task.

These four major components of the flow process are called components or profiles and the questions included in each make up a composite description of that profile. The four profiles are referred to as USER, TASK, UTILIZATION, and SEARCH AND ACQUISITION; and it is the relationships within and among these profiles that are investigated to define the interactions within the scientific and technical information flow process. Characteristics of the four profiles studied are:

- USER

  Includes age, education, equivalent GS rating (salary level), number of people supervised, years of experience, MOS equivalent or job code, type of work activity, kind of position, and field of position.

- TASK

  Includes kind, class, and field of task; task duration and percentage of time on task; and formality and type of task output.

- UTILIZATION

  Includes use of company Technical Information Centers, TAB, DDC, DOD Specialized Information Centers, STAR, and English abstracts or translations.

- SEARCH AND ACQUISITION

Includes class and field of information; composition, layout, depth and volume of information media; first source for information; and timeliness, and adequacy of information used in the task.

If either the one-way frequency distributions for questions or the two-way frequency distributions for pairs of questions are to have any visual or statistical significance (i.e., come into focus), it is necessary to organize the responses to the questions into a meaningful order. If anything other than isolated response associations (e.g., that of response 2 in Question A to response 3 in Question B) are to be indicated by the two-way frequency distributions, the responses to each question must be ordered in some meaningful way; so that the overall relationship of the questions can indicate a general trend. This ordering was accomplished by the detailed structure for all analyzed questions in Phase II.

The structure or ordering was based on five criteria: numerical value (number of days, amount, etc.), complexity (amount of detail required), formality (the exactness and structure of documentation, media, layout, etc.), relative "distance from nature" (the research, development and production cycle, and the conceptual, design and performance, and production cycle), and "distance from the individual or his work location" (this encompasses the aspects of the physical, environmental and organizational distance from the interviewee). The exact structure evolved for each question is presented in Appendix 12. This ordering of question responses allows one to talk in terms of higher level, more formality, longer durations, etc., when discussing the relationships between questions. Using these structured question responses, trends can be determined and used to interpret the question interactions. The ordering of the responses automatically associates a rudimentary equidistant scale with each question's responses and allows certain statistics (e.g., correlations which are actually rank correlations, and Chi-squares) to be computed. In addition, a relative or non-equidistant scale (numerical description) was developed for each question. The correlations reported below are based upon this relative scale.

The characteristics defined in the one-way frequency distributions are helpful for describing the internal structure of the basic elements making up the typical USER, TASK, UTILIZATION, or SEARCH AND ACQUISITION pattern. It is important, however, to determine whether a variation in one element is associated with or influenced by variation in another element. For example, while two one-way frequency distributions can separately characterize the user's kind of position and indicate the utilization of the Defense Documentation Center, a two-way frequency distribution (or a regression analysis) is required to answer such questions as "What is the association or interaction between the user's kind of position and his utilization of DDC?"

Chi-square measures the departure of the questions, associated with a two-way frequency distribution, from being independent or not related. The less the questions exhibit independence, the more they exhibit an interaction. On the other hand, the correlation (coefficient) measures the degree of linearity for the interaction between the two questions.

The frequency distribution results are presented below. First, the one-way frequency distributions and their significant features are described. Then the two-way frequency distributions are discussed in terms of Chi-square, correlation, and significant distribution features. This discussion focuses upon the details of two-question interactions, as exhibited by two-way frequency distributions and correlations. The next section focuses upon multi-question interactions, in less depth but more breadth, as exhibited by stepwise regression analysis of relationships among questions.

5.2 ONE-WAY FREQUENCY DISTRIBUTIONS

The more significant results from the one-way frequency distributions established for each Phase II question are discussed in this section. The complete distribution for individual questions may be found in Appendix 12 and in Volume III. The discussion is organized around the four study profiles of USER, TASK, UTILIZATION, and SEARCH AND ACQUISITION, with an additional description of the interviewer's assessments of the TASK and the USER's information needs, acquisition and use.

USER Profile

The USER profile is a set of questions involving the education, experience and normal position or job of the interviewees. This general profile is one of the first broadly-based estimates for the composition of the some 120,000 scientific and engineering personnel employed within the defense industry.

Education

All but thirteen percent of the sample had college degrees, with 32% having advanced degrees (Figure 5-1). These degrees were in 60 unique academic fields, with the various engineering degrees accounting for the majority of the fields (see Figure 5-2).

The most predominant engineering field was electrical, which represented 25.5% of all college degrees. The second highest engineering field was mechanical, representing 17%.

Experience

Interviewee experience was adjudged from his years in his work area, years with his present company, and age. The mode for number of years in the same area of work was four years (10%) and the median was 8 years, with 39% of the population having been in their work area for ten years or more (see Figure 5-3). The number of years with the current company shows the same relationship, with the mode at four years (9%) and the median at seven years, with 35% of the respondents having been with the company ten years or more (Figure 5-4). The median age of the interviewees was 38 years, with the mode falling at 35 years of age (6%).

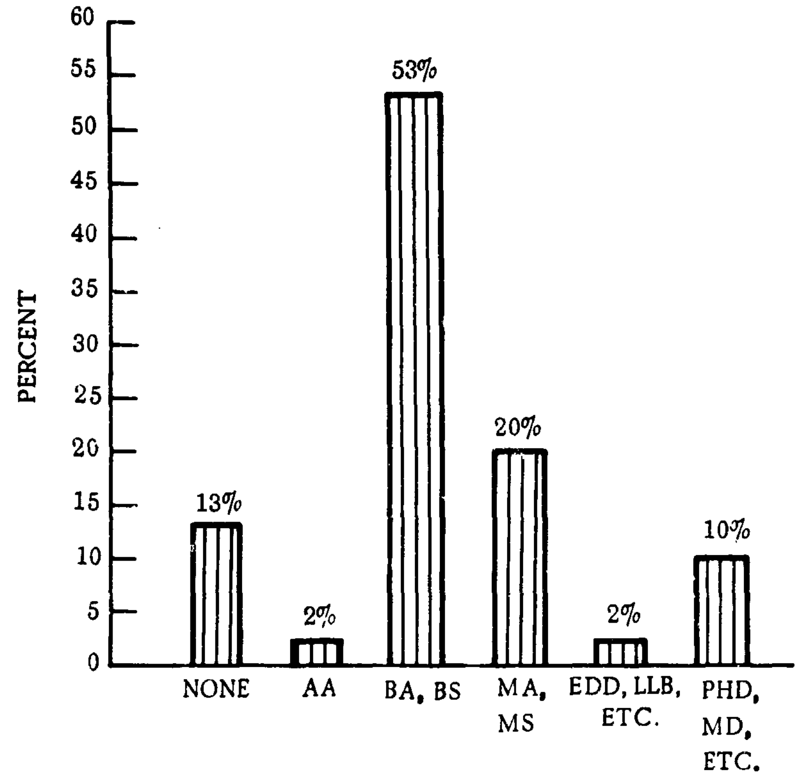


Figure 5-1. User's Highest Degree

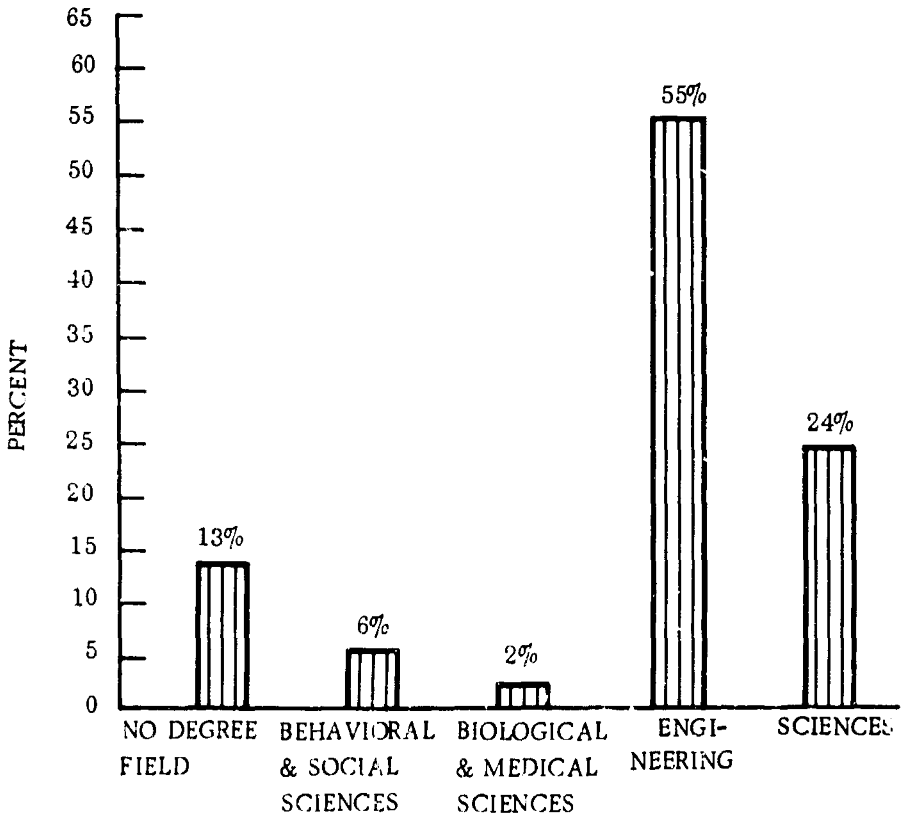


Figure 5-2. User's Field of Degree

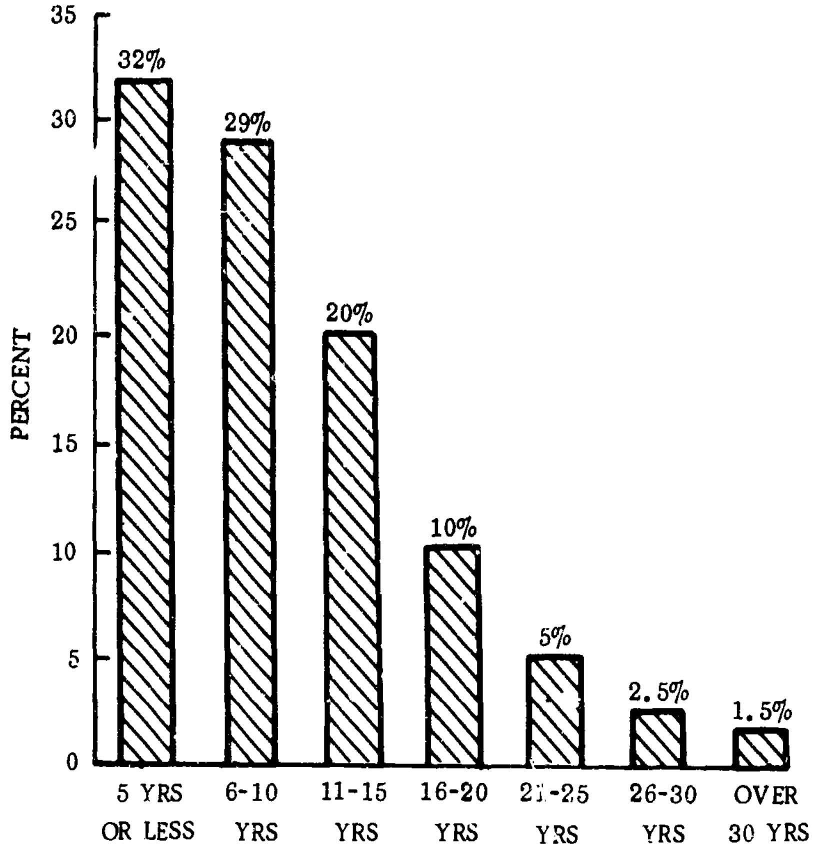


Figure 5-3. User's Job Experience

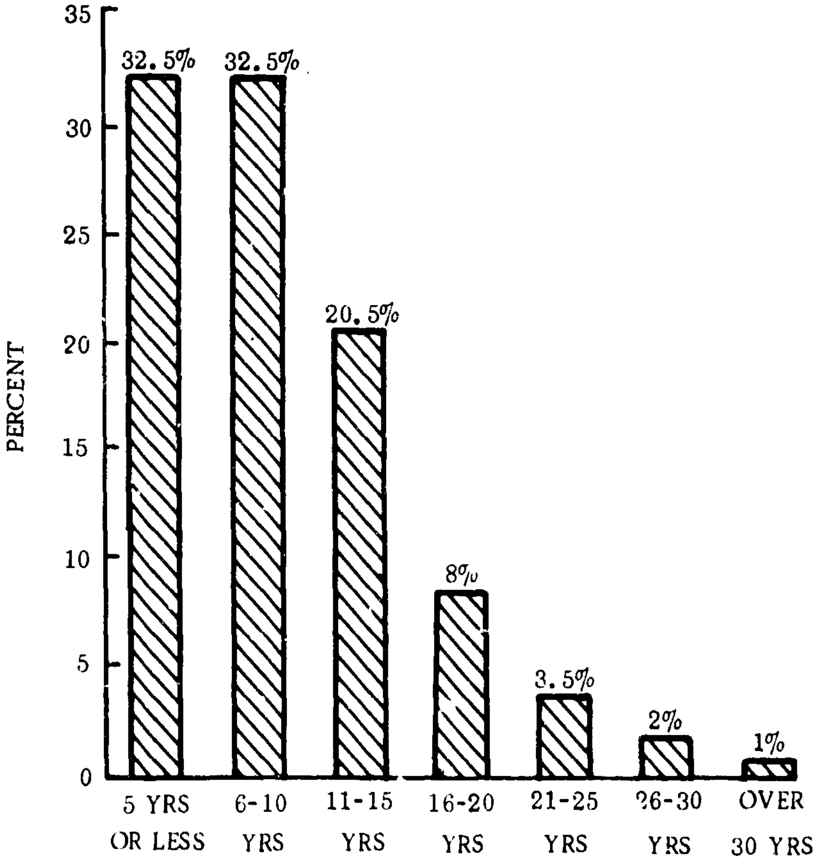


Figure 5-4. User's Company Experience

Position

The interviewees position is described by his kind of position, field of position, management/supervision responsibilities, and salary level. The largest number of respondents (38%) are involved in some aspect of developmental work. The second largest activity is research, where some 20% of the sample was engaged (see Figure 5-5).

Although the interviewees were working in 33 classifications of field of position, seven individual fields account for 69% of the total (see Table 5-1).

Table 5-1. Interviewee Classification

Field		% of Total
Electronics and Electronic Equipment		22.5
Aircraft and Flight Equipment		14.0
Production and Management		8.0
Research and Research Equipment (including Computer Science)		7.5
Guided Missiles		7.0
Chemistry		5.0
Propulsion Systems		5.0
	TOTAL	69.0

When the fields of work position are grouped they have the characteristics represented in Figure 5-6.

Management activities were performed by 33% of the scientific and engineering personnel. Forty percent of the interviewees had no supervisory responsibility; of those with this responsibility, 52.5% supervised from 1 to 5 people and 32.5% supervised from 6 to 10 (see Figure 5-7). Fifty-five percent of the sample was primarily involved in non-management scientific and technical activities and the remaining 12% carried out technical evaluation activities (Figure 5-8). The median salary level, obtained by asking the interviewee for his equivalent GS rating, is in the range of $12,000 - $14,000 (GS-13). Each of five GS ratings, GS-11 through GS-14 ($8,000 - $16,499), contain approximately the same proportion of the sample and represent 75% of the total (see Figure 5-9).

TASK Profile

Data (or information) are not independent quantities and must be related to a need or purpose, in order to establish a meaningful connotation and definition of their operational information content. Hence, the study developed a description of the

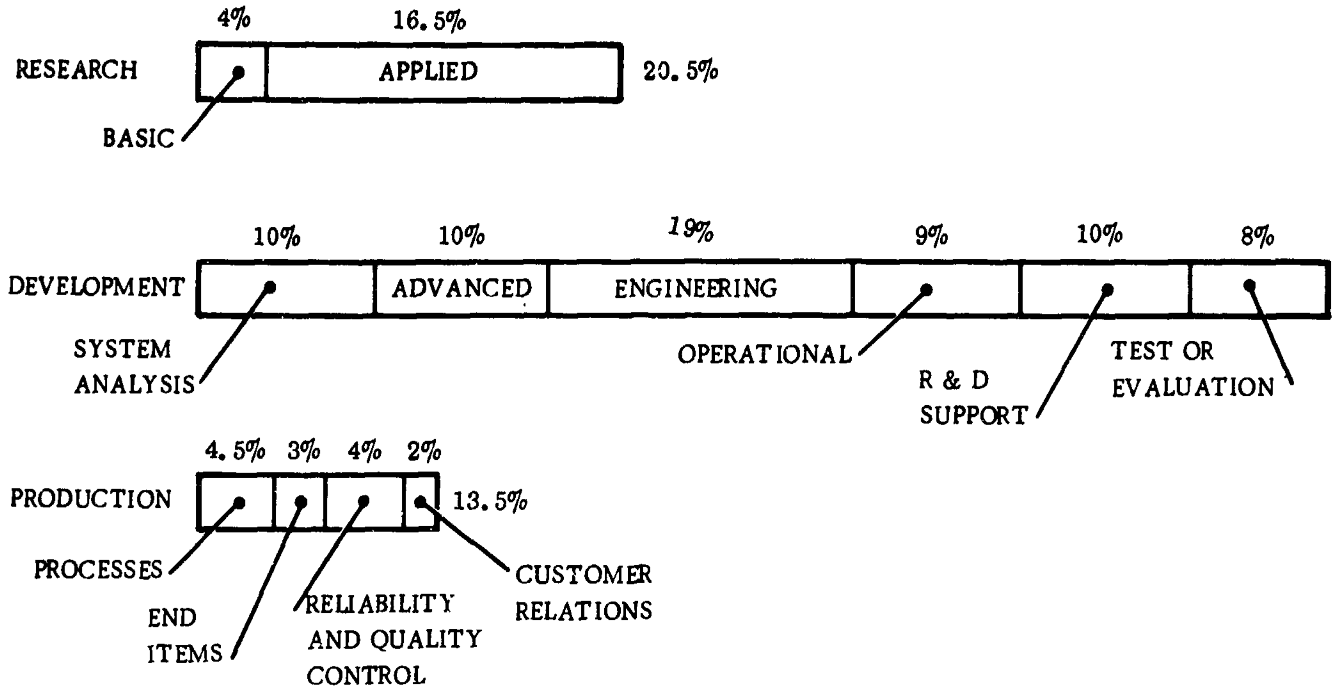


Figure 5-5. User's Kind of Position

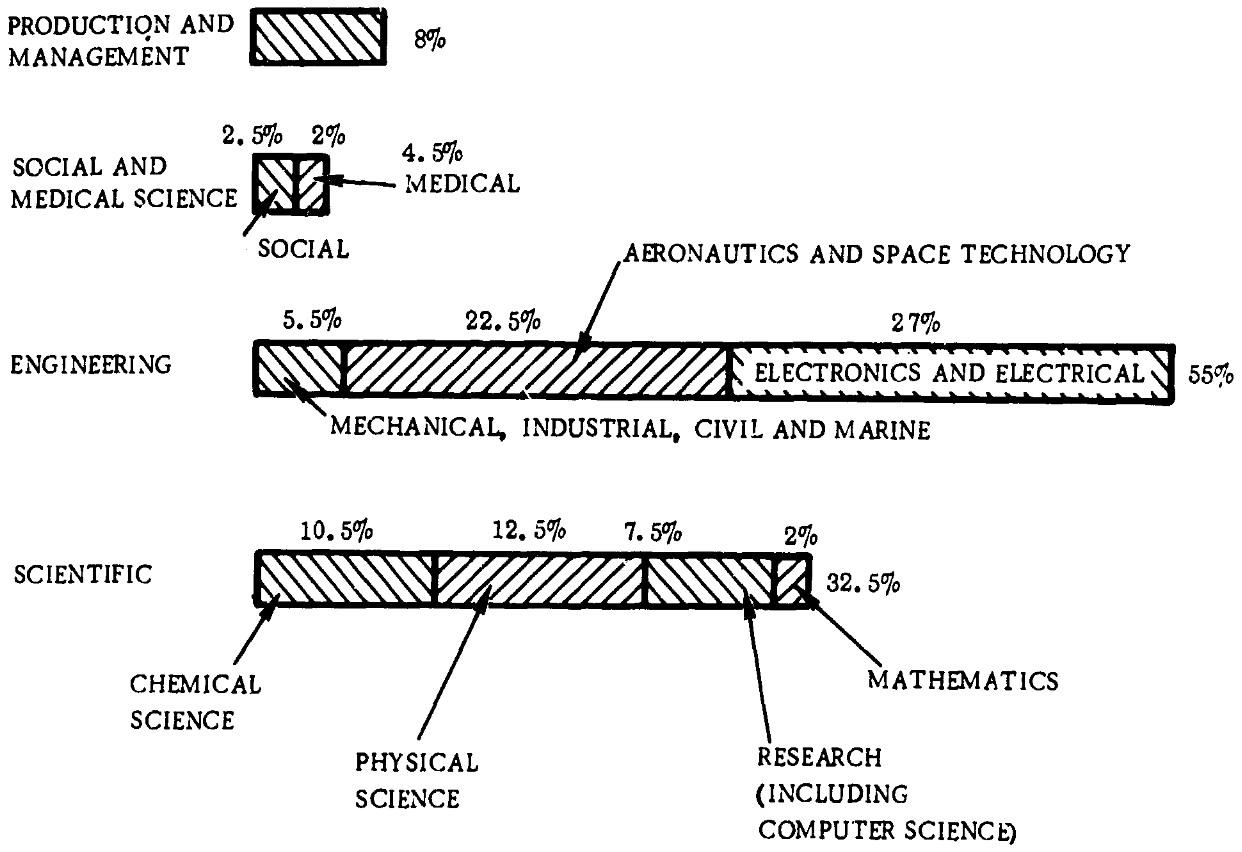


Figure 5-6. User's Field of Position

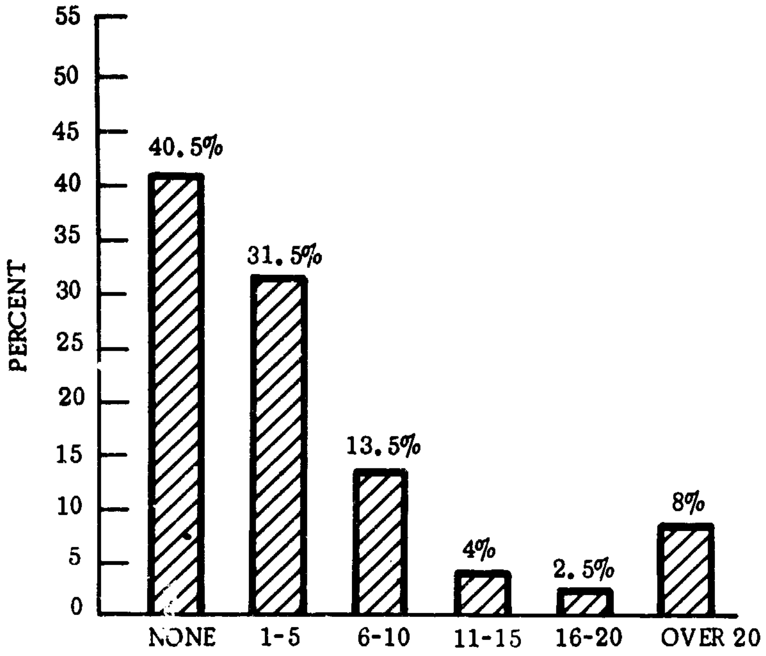


Figure 5-7. Number of Personnel Supervised by User

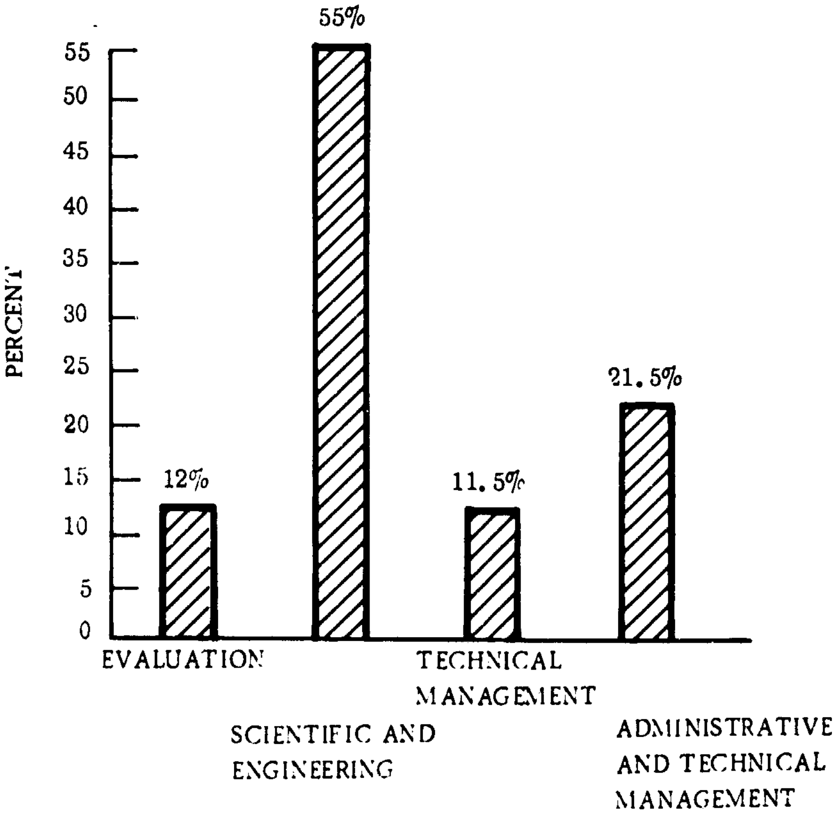


Figure 5-8. User's Type of Activity

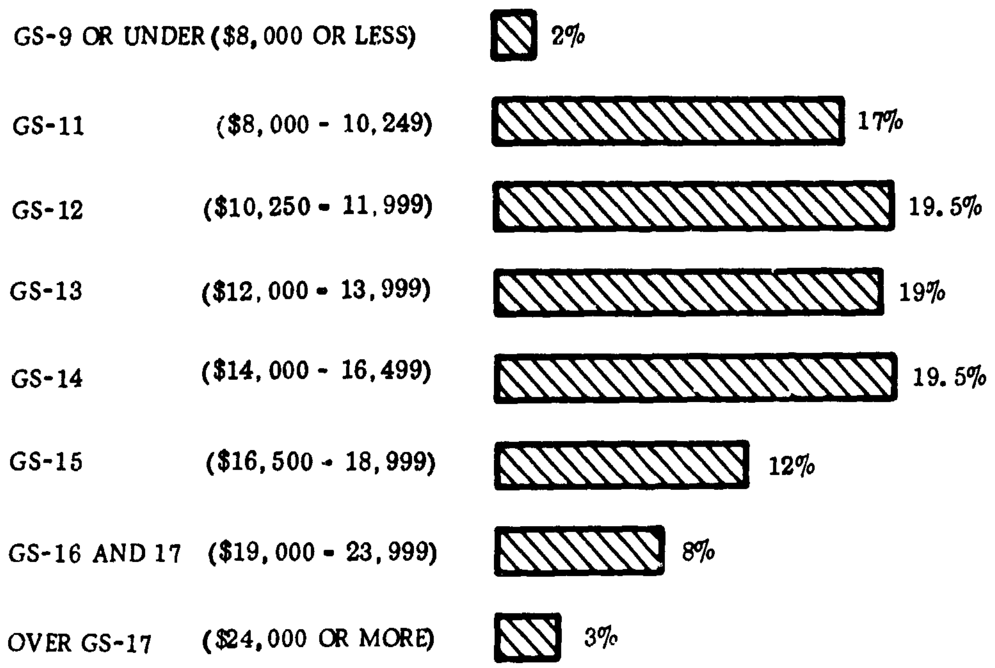


Figure 5-9. User's Equivalent GS Rating (Salary Level)

scientific and technical information process around one particular task for each interviewee. This task was the last one completed by the interviewee, giving a random selection of tasks and not an investigation of the most prominent or glamorous tasks. The tasks were described by the source of initiation (initiator). the characteristics of the task output, and the times involved in task completion.

Task Initiator

The majority of tasks (70%) were initiated from above; by supervision, upper management or the customer (Figure 5-10).

Task Output

The task characteristics of kind and field reflect those established for the position of the interviewee. Development (33.5%) and Research (20%) dominate the task descriptions (see Figure 5-11) and the seven position fields that are heavy in the USER description make up 64% of the responses in the 33 task fields (see Table 5-2). Note the similarity between the grouping of task fields in Figure 5-12 and that of position fields in Figure 5-6. The areas of design and design techniques (24%) and performance and characteristics (16%) are the largest class of task descriptors (see Figure 5-13).

Most frequently the outputs are findings (51%) and seldom decisions (4%), as indicated in Figure 5-14. Seventy percent of the tasks yield a formal output consisting of a formal. highly structured document, briefing, or demonstration; while the remainder are informal documents. briefings. discussions or hardware. Of notable importance is the fact that 89% of the task outputs are some form of documentation (66% formal and 23% informal). See Figure 5-15.

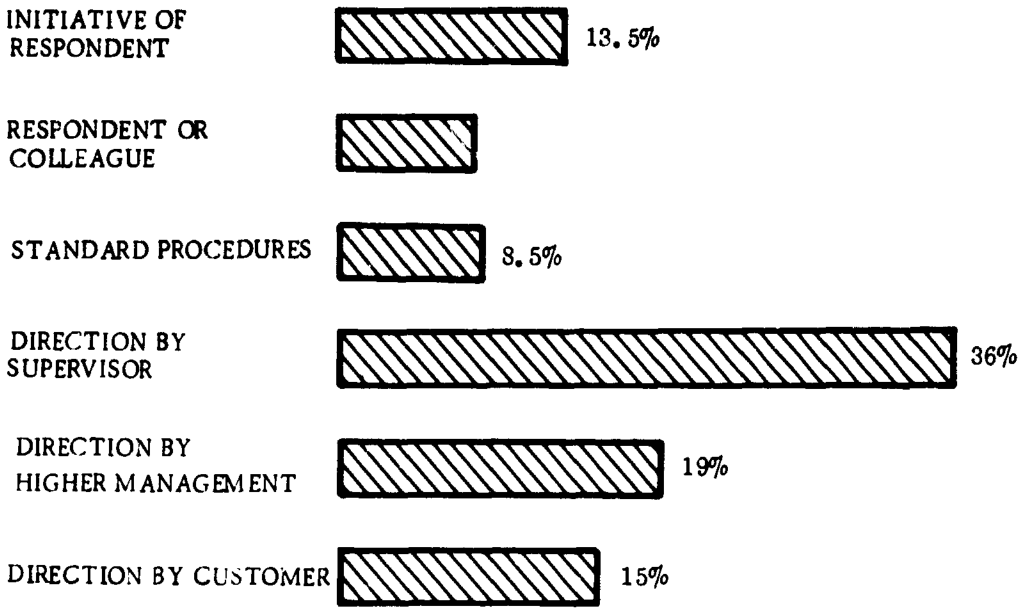


Figure 5-10. Task Initiator

Table 5-2. Task Field Responses

Field of Task	% of Total
Electronics and Electronic Equipment	17.0
Aircraft and Flight Equipment	13.0
Research and Research Equipment (including Computer Science)	9.0
Guided Missiles	8.5
Production and Management	7.0
Propulsion Systems	5.0
Chemistry	4.5
TOTAL	64.0

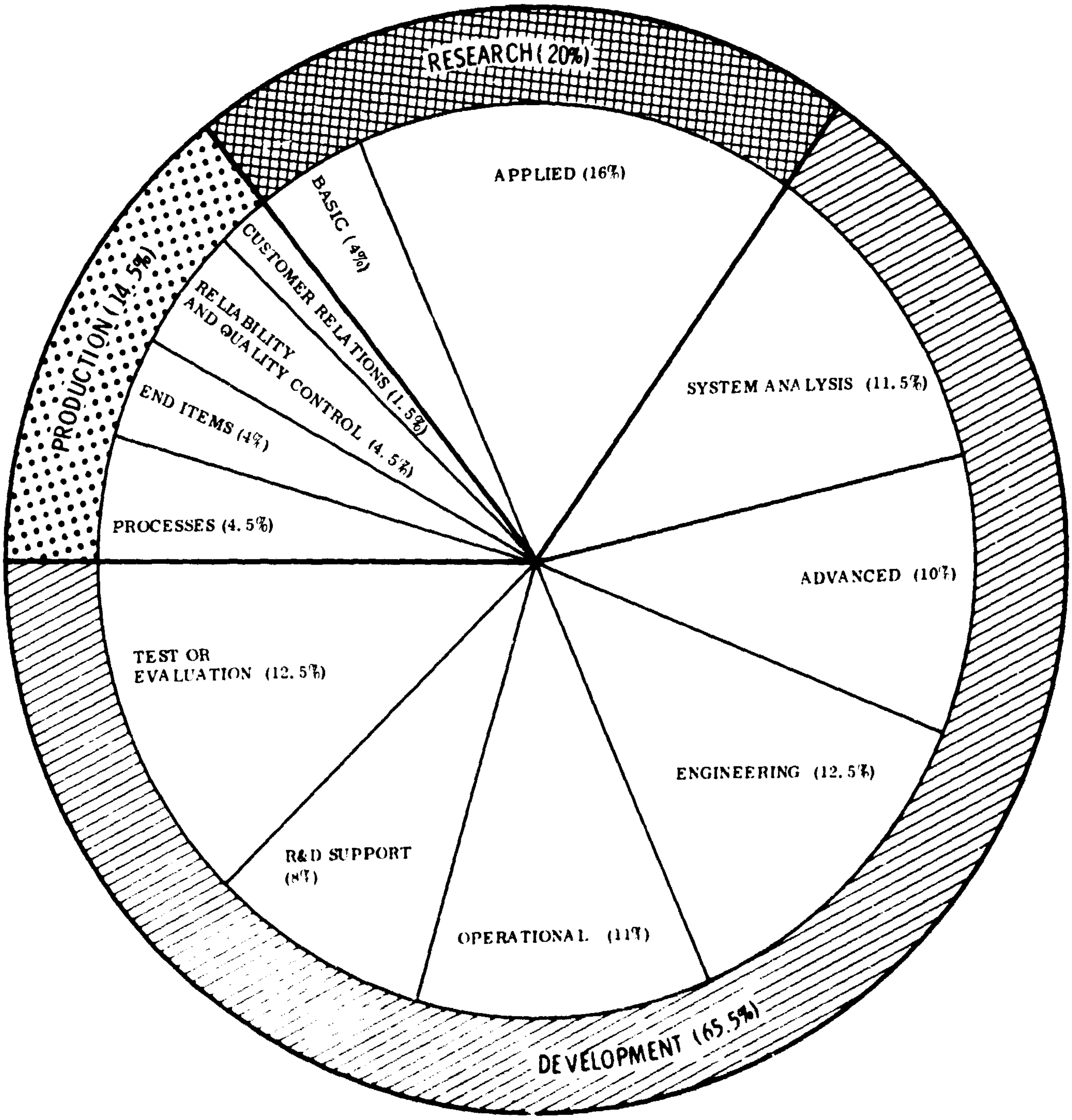


Figure 5-11. Kind of Task

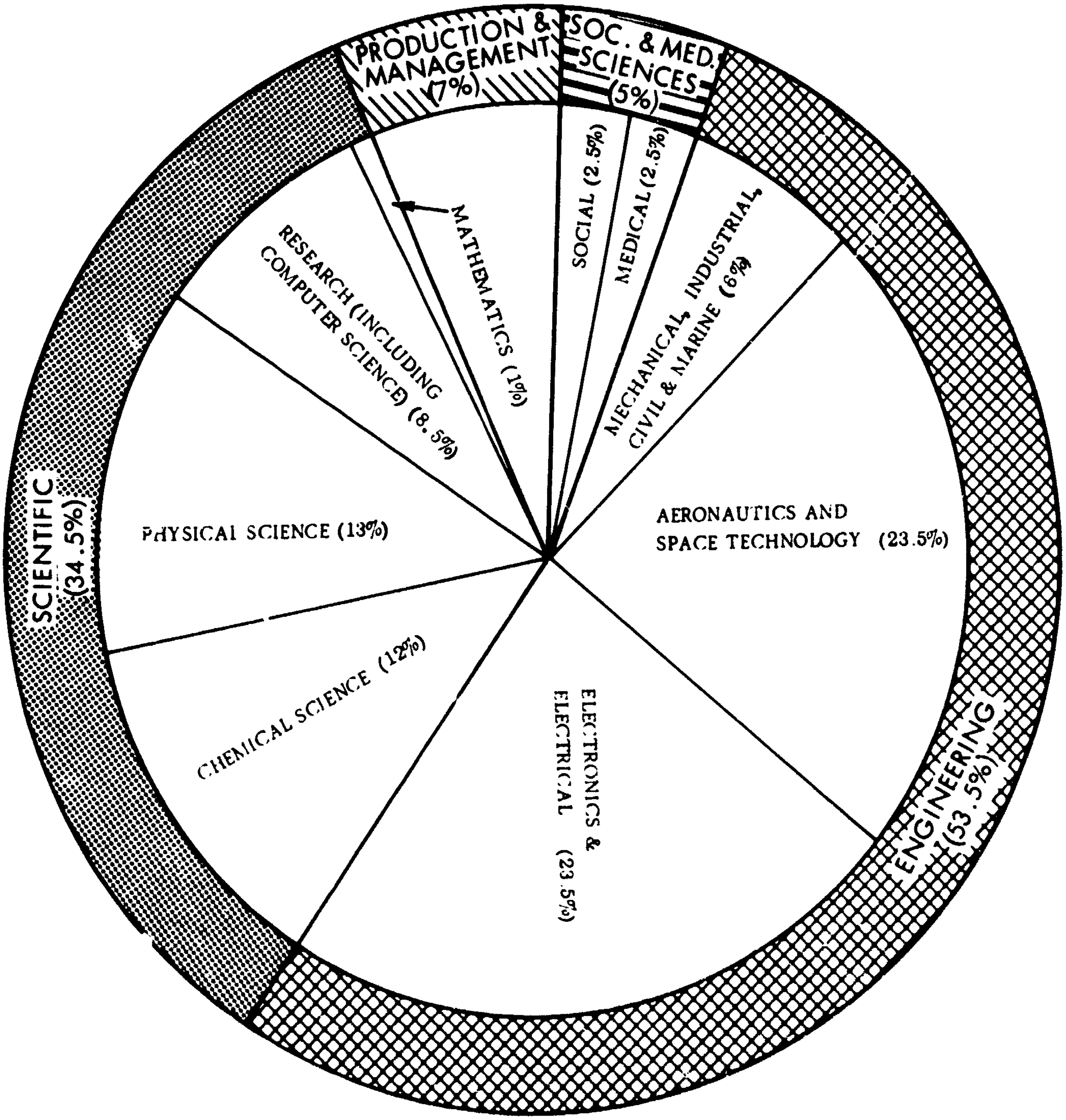


Figure 5-12. Field of Task

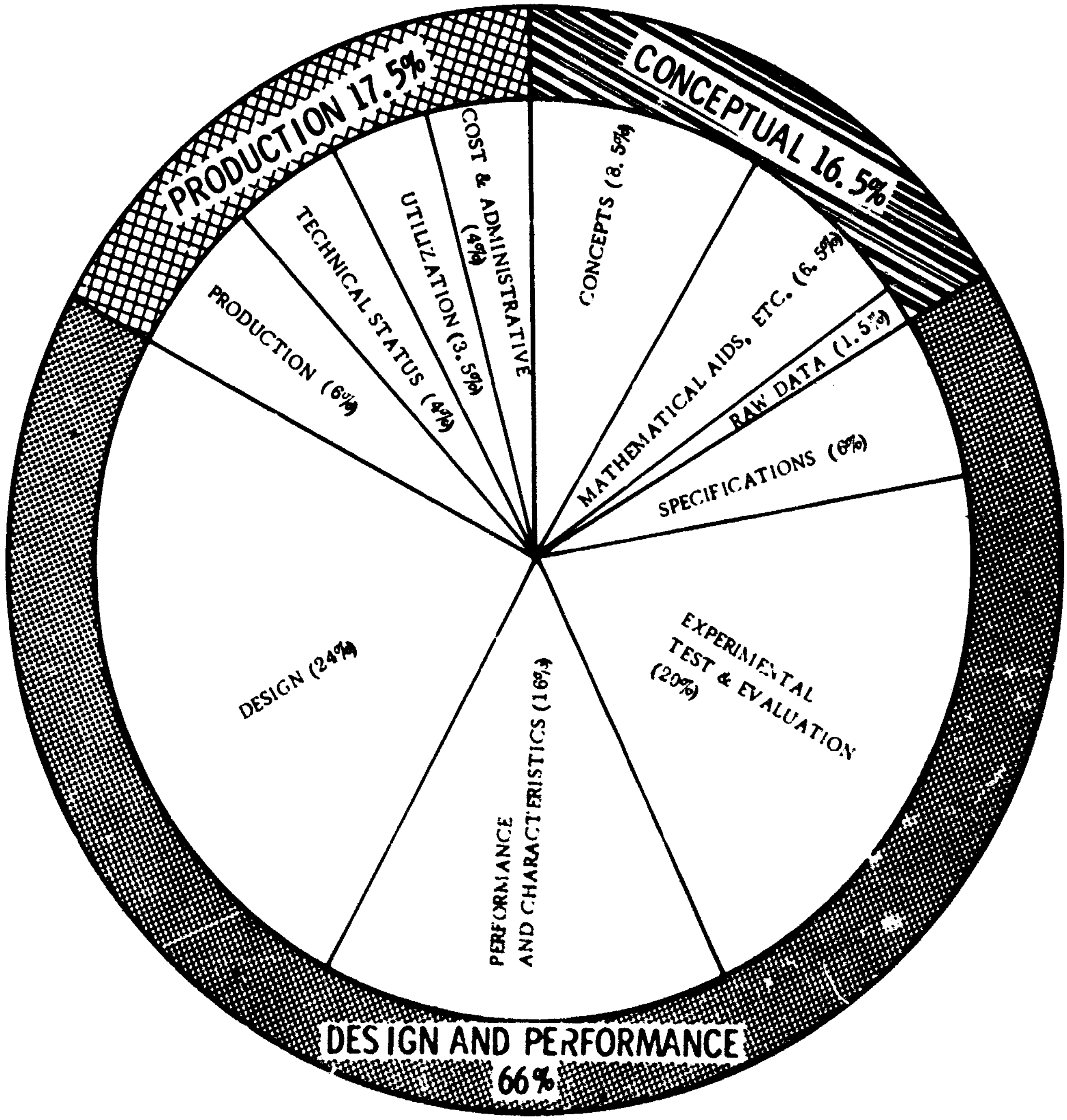


Figure 5-13. Class of Task

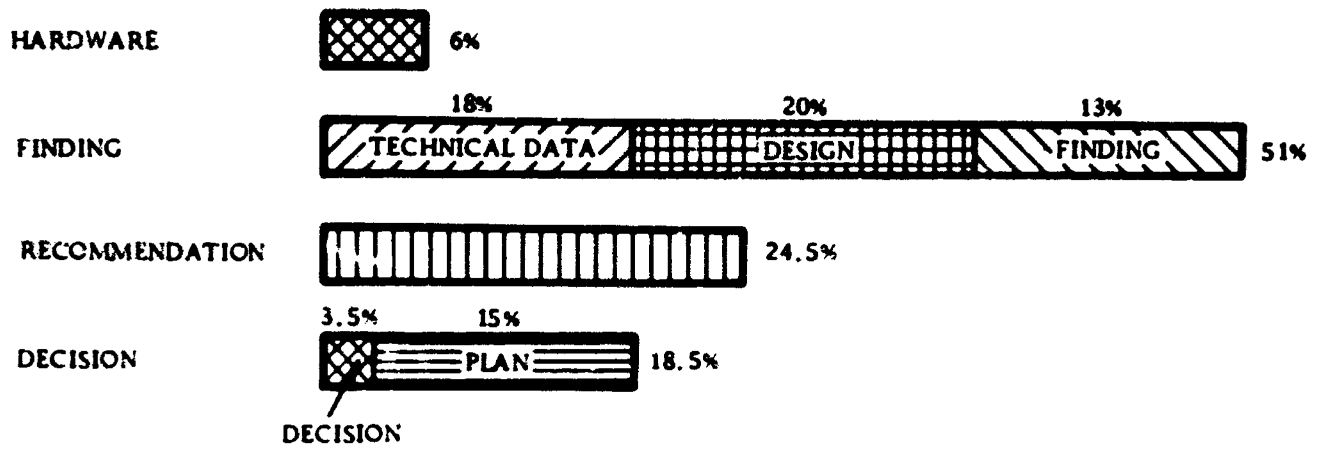


Figure 5-14. Type of Task Output

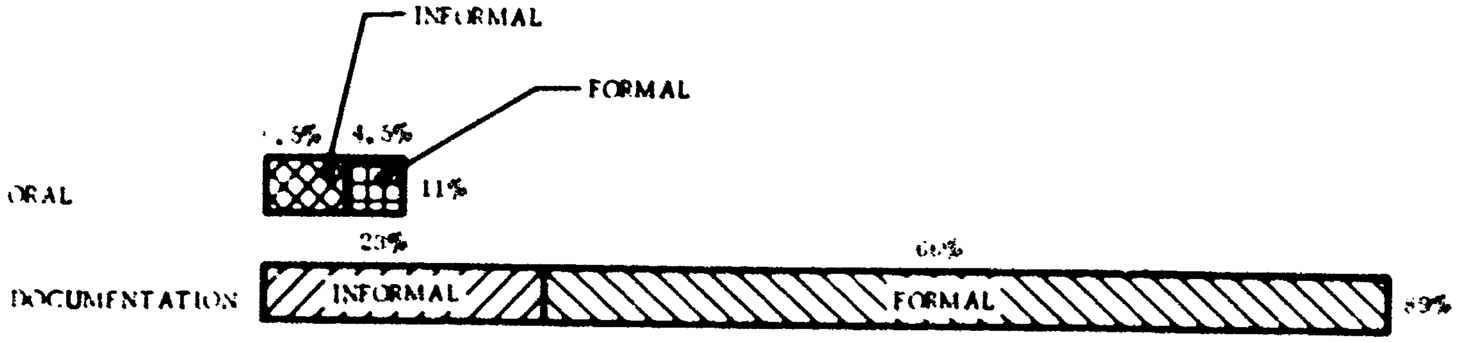


Figure 5-15. Formality of Task Output

The task outputs were mostly directed to a recipient within the respondent's company (59.5%), with an additional 1.5% being for his own use only. The remaining 39% of the task outputs were sent directly to an external company recipient, 34.5% going to an outside organization and the other 4.5% directed to a professional group (3.0%) or an industry (1.5%). See Figure 5-16.

Task Times

The total elapsed time required to complete a task varies from one day to over a year, with the median time being between 22 and 28 days (Figure 5-17). The amount of the respondent's work time spent on the task was broken down into increments of 25% (i.e., 1-24, 25-49, etc.) and full time. Each of the resultant five response categories contained approximately 20% of the tasks, with only 22% of the interviewees spending full time on the task.

UTILIZATION Profile

In determining characteristics associated with the interviewee's utilization of existing information facilities, four general topics were covered:

- DOD information centers and services.
- Company technical information centers.
- Other (non-company) information centers and services.
- Restrictions and difficulties associated with this utilization.

DOD Information Centers and Services

Questions were asked concerning the Defense Documentation Center (DDC), Technical Abstract Bulletins (TAB), and DOD Specialized Information Centers. The responses to these questions show that 68.5% of the sample know about DDC, but only 45.5% actually use it either directly or through their company Technical Information Center (Figure 5-18). TAB is known to some 56.5% of the interviewees, but is used by only 35%. Every, or almost every, issue is used by 13.5% of the sample (see Figure 5-19). DOD Specialized Information Analysis Centers are used by 44% of the interviewees, with another 19.5% knowing of the existence of the centers, but not using them (Figure 5-20). The most frequently used centers are presented in Table 5-3.

Company Technical Information Centers

The respondent was asked to define the services presented by his company Technical Information Center (TIC), his use of the TIC, and his assessment of its performance. All but eleven respondents reported that their companies maintained a library or TIC, but 5% of the interviewees were unfamiliar with the TIC due to non-use. Sixty-eight percent reported that they regularly use the company TIC, while [illegible] use it on an "as-needed-basis". See Figure 5-21. Some three-fifths of the respondents indicated that they were satisfied with the services presented by the TIC. Those elements of inadequacy are presented in Figure 5-22.

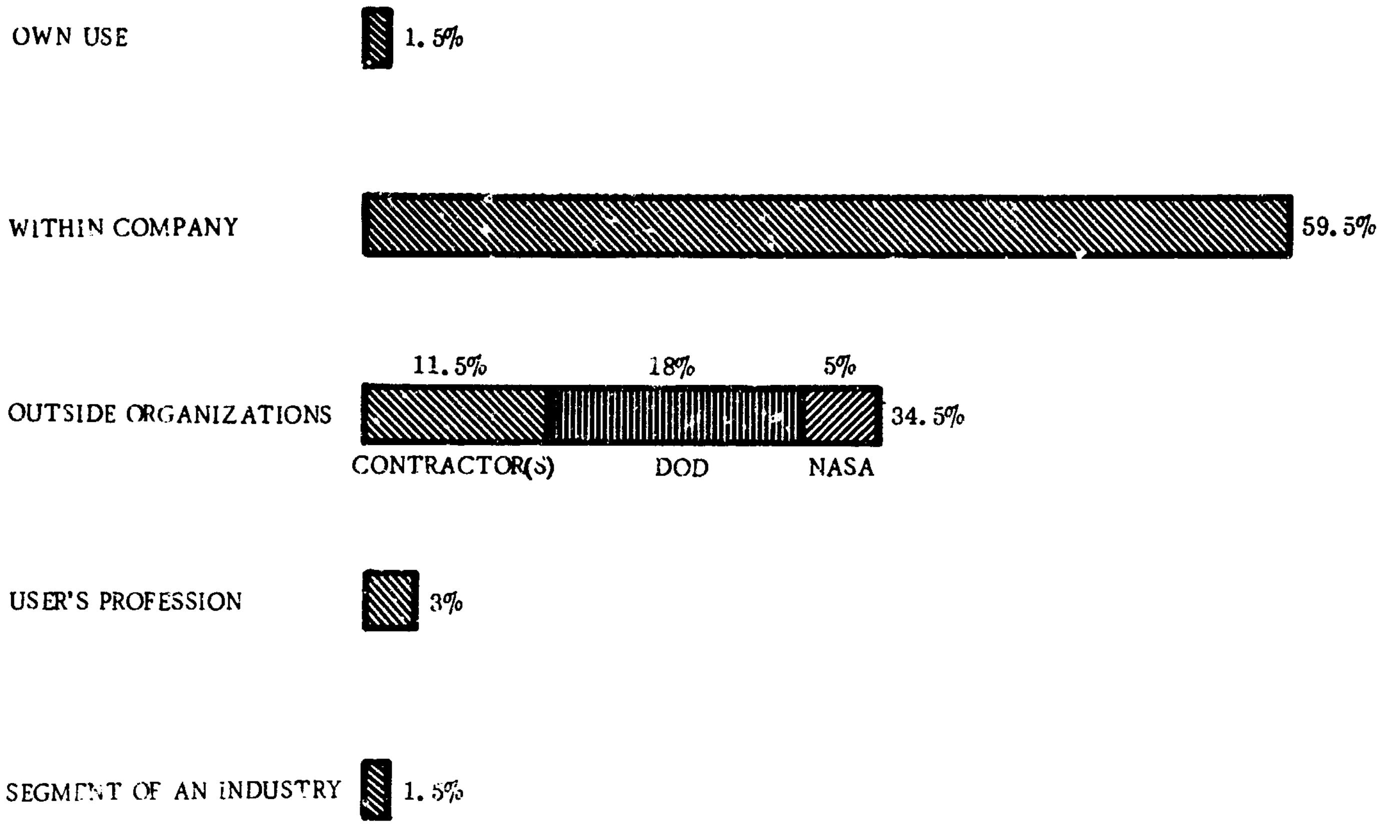


Figure 5-16. Task Recipient

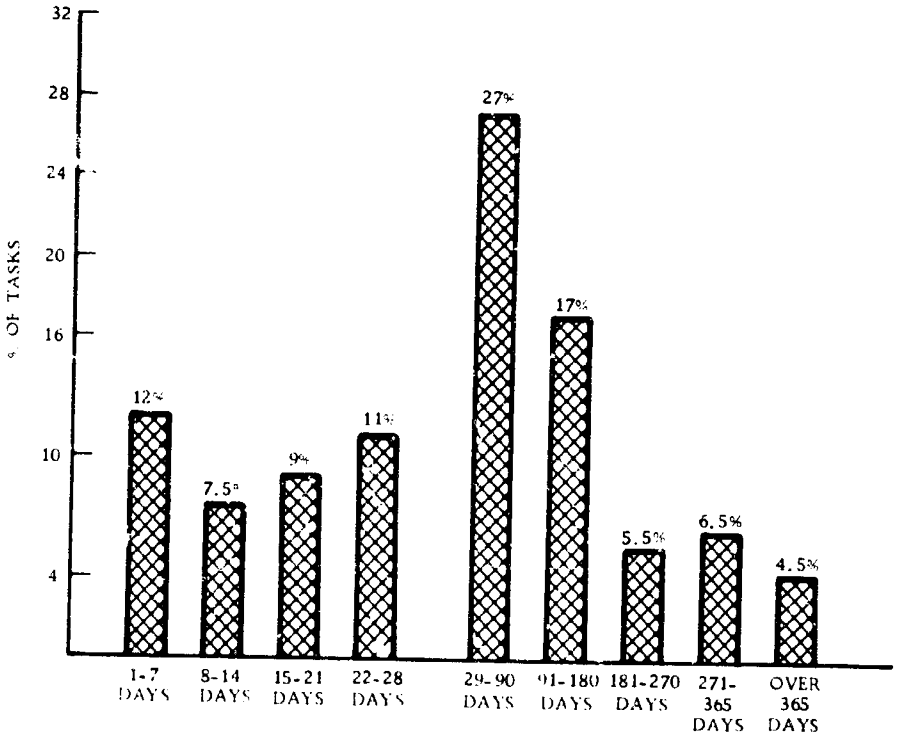


Figure 5-17. Task Duration

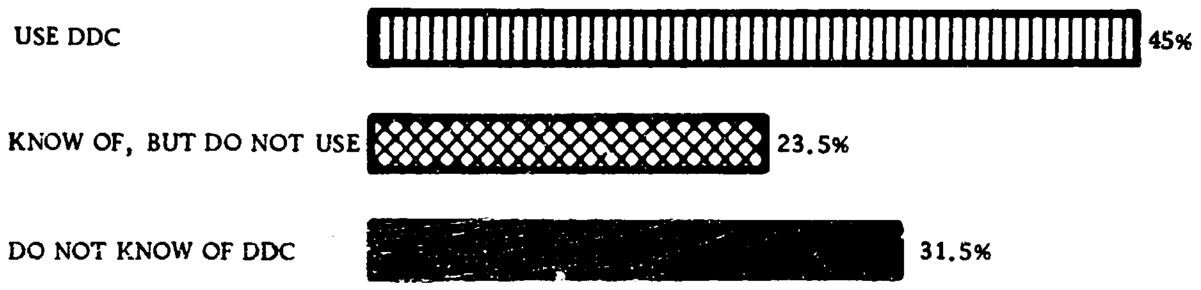


Figure 5-18. Use of Defense Documentation Center

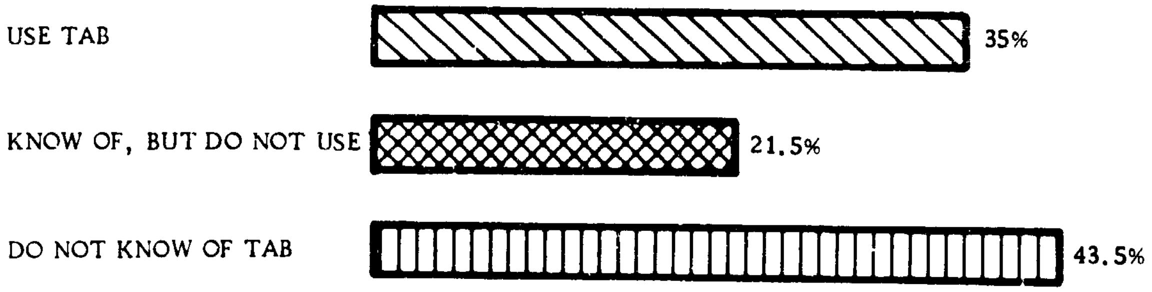


Figure 5-19. Use of Technical Abstract Bulletin

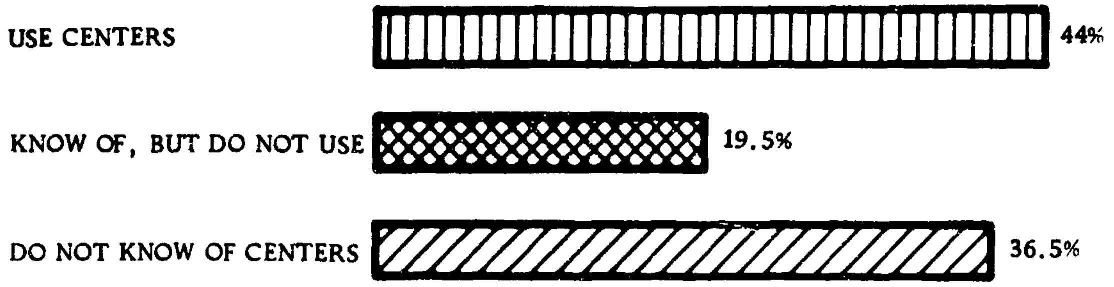


Figure 5-20. Use of DOD Specialized Information Centers

Table 5-3. Most Frequently Used DOD Specialized Information Centers

Center Used Most Often	% of Users
Defense Metals Information Center	17
Interservices Data Exchange Program	16.5
Index of Specifications and Standards	9
Radiation Effects Information Center	8
Chemical Propulsion Information Agency	6.5
Infrared Information and Analysis Center	6.5
Shock and Vibration Information Center	6.5

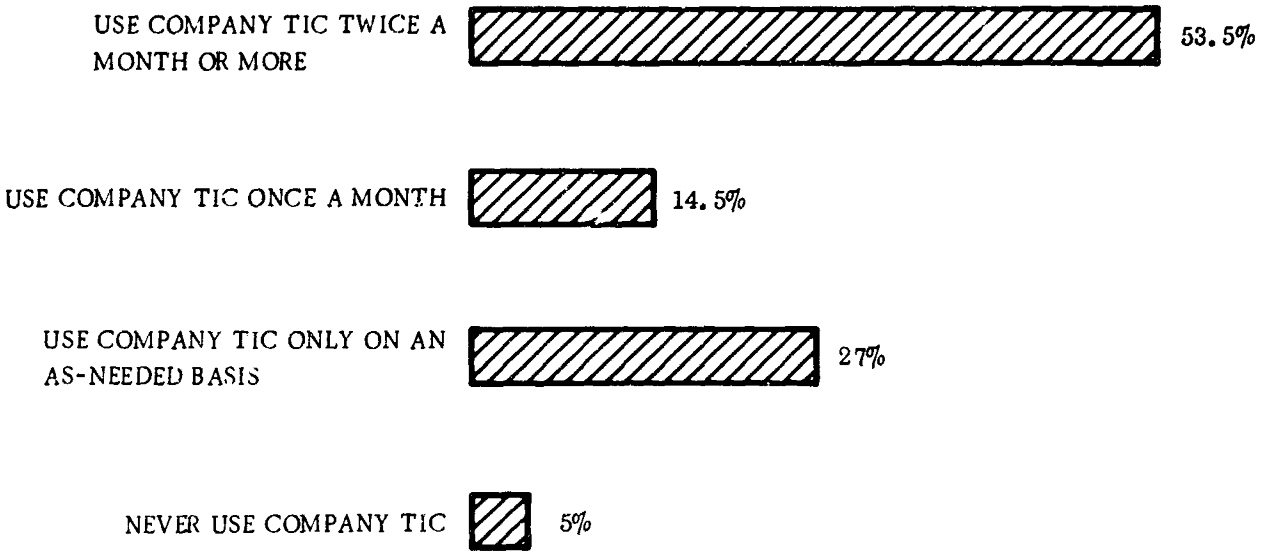


Figure 5-21. Use of Company Technical Information Center

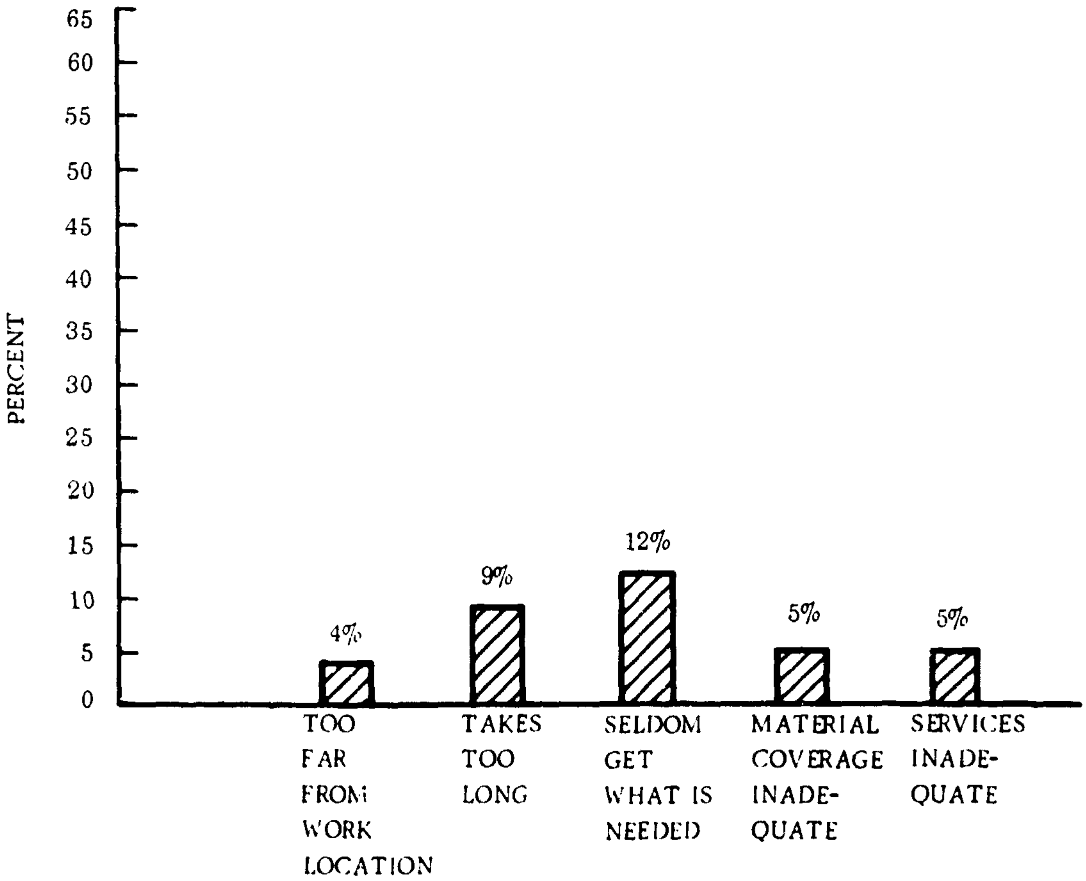


Figure 5-22. Company Technical Information Center Inadequacies

Other (Non-Company) Information Centers and Services

The respondent was also asked to define his use of NASA's Scientific and Technical Aerospace Reports (STAR), Non-DOD Specialized Information Centers, and English abstracts or translations. STAR was unknown to 63.5% of the sample and used by 18.5% (Figure 5-23). Non-DOD Specialized Information Centers (including services provided by colleges and universities, Government organizations, professional societies, and private institutions) were used by some 30% of the interviewees. Forty percent of the interviewees indicated that they had used English abstracts or translations in their past work.

Problems

An inquiry was made into the problems encountered in acquiring information. Four areas of interest were:

- The type of difficulties encountered in the acquisition and use of information.
- Possible solutions to these difficulties.
- The effects of restrictions placed on information.
- When useful information was discovered after a task was completed.

Forty-two and one half percent of the interviewees stated that they had difficulties in obtaining or utilizing technical information needed to complete tasks on which they had worked. These difficulties centered around being aware of, acquiring, and using information (see Figure 5-24). The solutions that were proposed for alleviating the difficulties are presented in Figure 5-25.

Thirty-five percent of the sample reported having problems with special restrictions placed on information. Forty percent of these individuals reported problems caused by proprietary restrictions being placed on information, and 59% reported

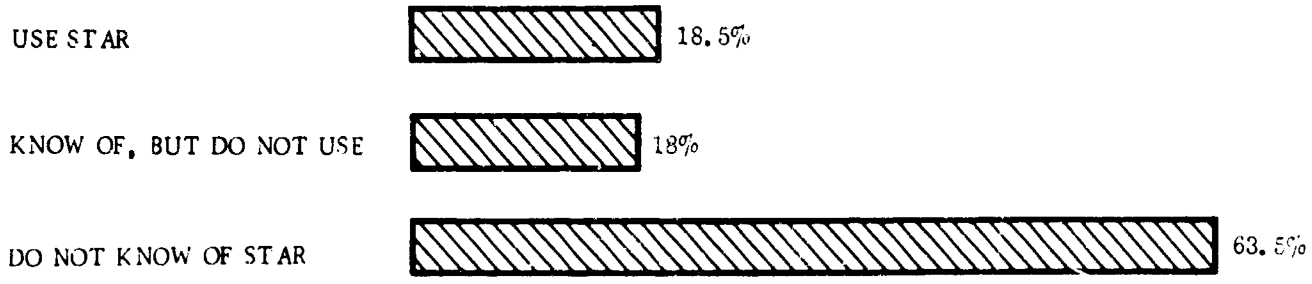
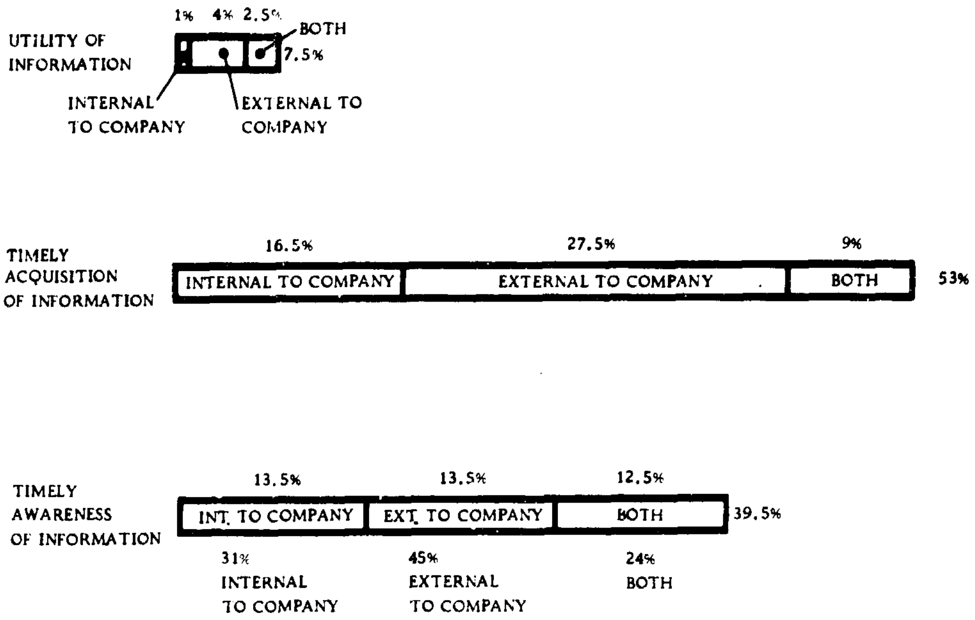


Figure 5-23. Use of Scientific and Technical Aerospace Reports



*BASED ON THE CATEGORIZATION OF 628 APPROPRIATE NARRATIVE ANSWERS, OF THE 639 ANSWERS TO THE QUESTION.

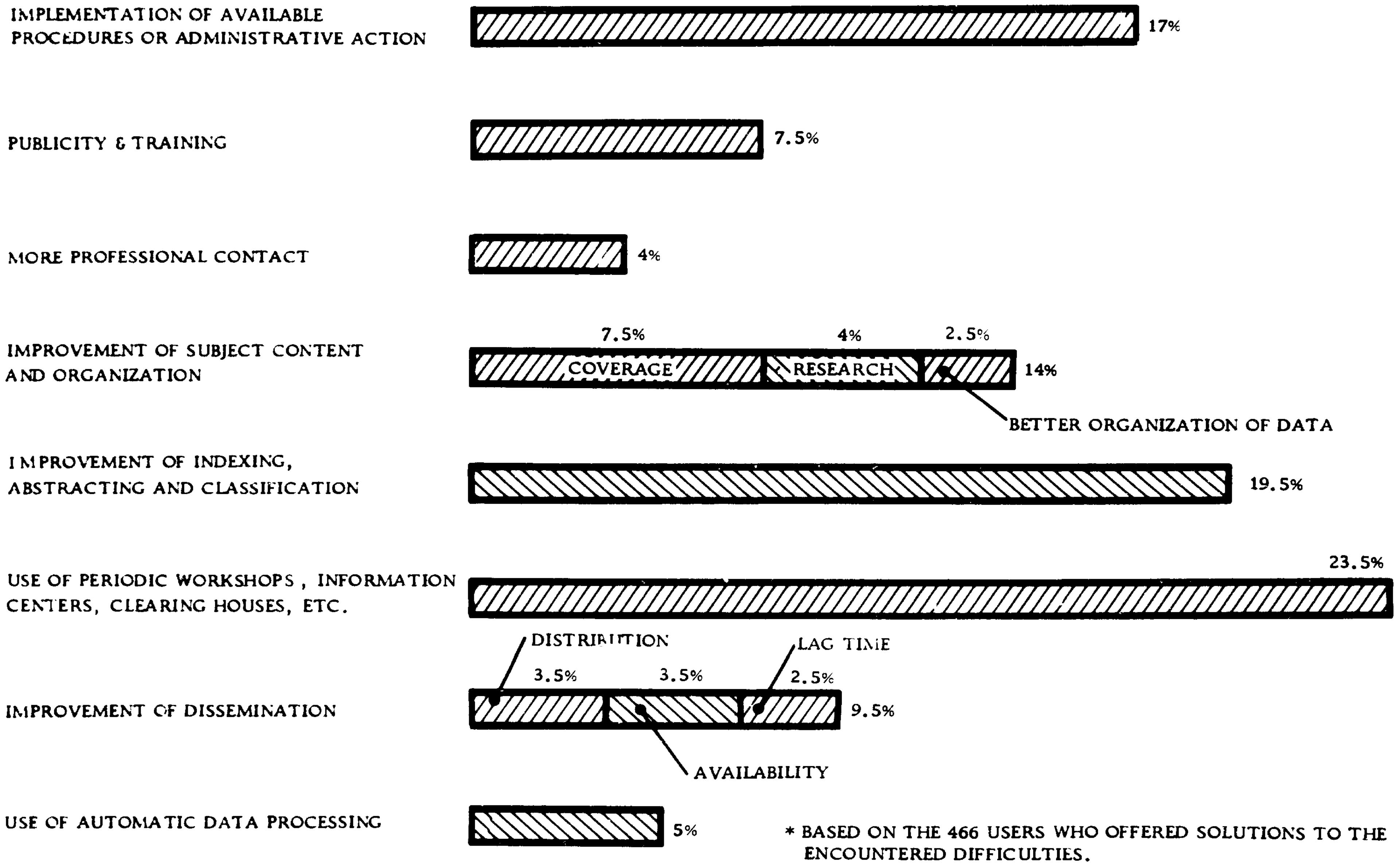
Figure 5-24. Nature of Difficulties

problems caused by security classifications applied to information. The proprietary restrictions were mostly ascribed to vendors and other companies, while security restrictions involved need-to-know and acquisition problems (Figure 5-26).

Twenty percent of the respondents indicated that they had learned of relevant information that was available, but unknown, during the course of the task investigated for this study.

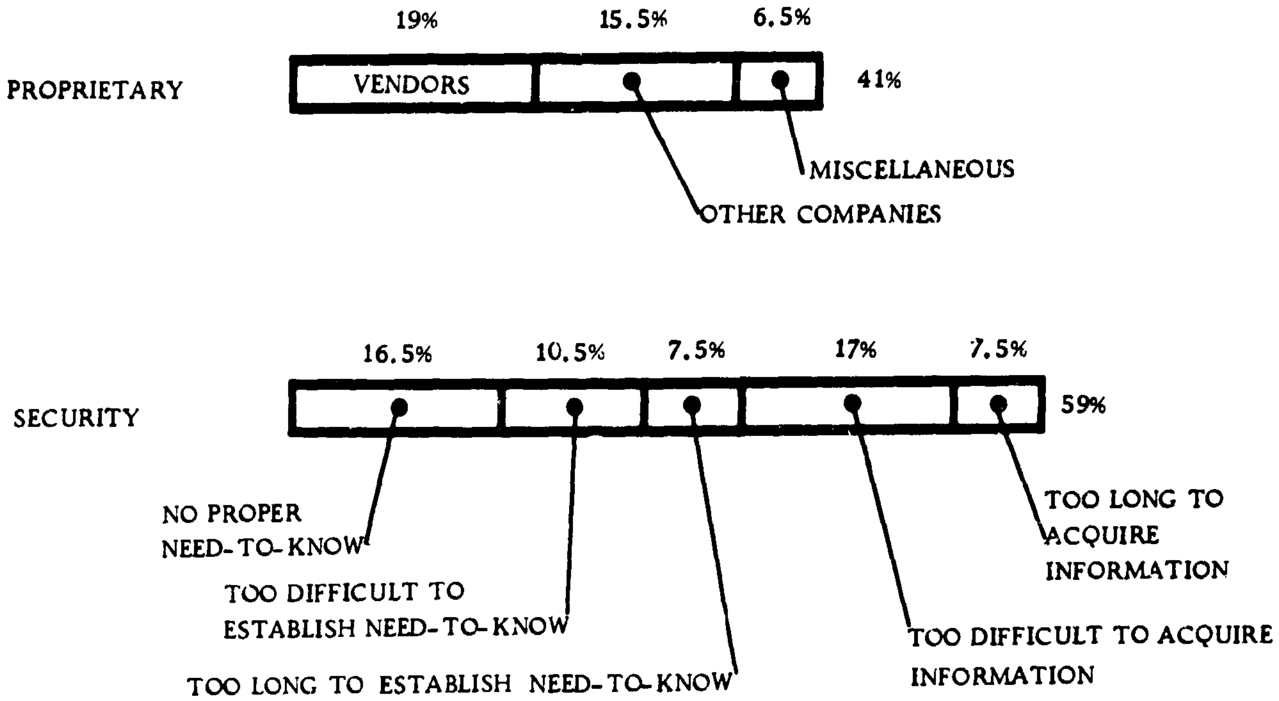
SEARCH AND ACQUISITION Profile

The SEARCH AND ACQUISITION profile characterizes the elements of the scientific and technical information flow process that were used to carry out the tasks under investigation in this study. In order to complete a task certain information must be defined, the source located, and the information acquired. Tasks usually required more than one unit of information, each of which may have different search and acquisition characteristics. Therefore, the first step was to obtain narrative descriptions of the definable natural units of information required for a task. These units were referred to as information chunks (see Section 1). Then the set of search and acquisition characteristics associated with each chunk was obtained. The fifteen hundred tasks investigated during the study produced 5,359 chunks or units of information (an average of 3-1/2 chunks per task). Consequently those questions concerning SEARCH AND ACQUISITION characterize these chunks, and are only a reflection of the TASK and the USER. That is, one may refer to the proportion of information chunks having certain characteristics, but not necessarily to the fact that a certain proportion of the users or tasks have these same characteristics. Statements of the latter type may be made after additional analysis (see Section 8).



* BASED ON THE 466 USERS WHO OFFERED SOLUTIONS TO THE ENCOUNTERED DIFFICULTIES.

Figure 5-25. Solutions for Difficulties



*BASED ON THE 451 APPROPRIATE NARRATIVE ANSWERS, OF THE 525 ANSWERS TO THE QUESTION.

Figure 5-26. Nature of Restrictions

The description of these information units deals with the first source approached for information, time and volume characteristics, formality of the media which conveys the information, and characteristics of the information content.

First Source Characteristics

The interviewee was asked to indicate where he first went to get his information, what he wanted to know, why he went to that particular source, and what he received from this first contact. The most frequent first source was the individual himself, whereby he either recalled from memory the information required (19%), searched his own personal collection for the information (13%), or produced the information through his own action (2.5%). Some 10.5% of the information units were received with the task assignments and required no initial search. The respondent went to the people immediately around him for 29.5% of the information (colleagues - 14.5%, subordinates - 4.5%, supervisors - 1%, and internal company consultants - 9.5%), and to people outside his immediate environment 7.5% of the time (supplier or manufacturer - 4.5%, external consultant - 1%, and the customer - 2%). Non-personal document sources were utilized as the first contact for 18% of the information chunks (departmental files - 5.5%, company TIC - 10%, supplier or manufacturer files - 1.5%, external library - 0.5%, and DOD information or data center - 1%). Thus, the first source contacted was: a person (including recall) for 58.5% of the chunks, and a document collection (including the interviewee's own collection) for only 31% of the chunks. Another way of looking at the first source contacted is in relation to the "distance from himself or his work location" that the individual went to acquire information. This aspect is presented in Figure 5-27.

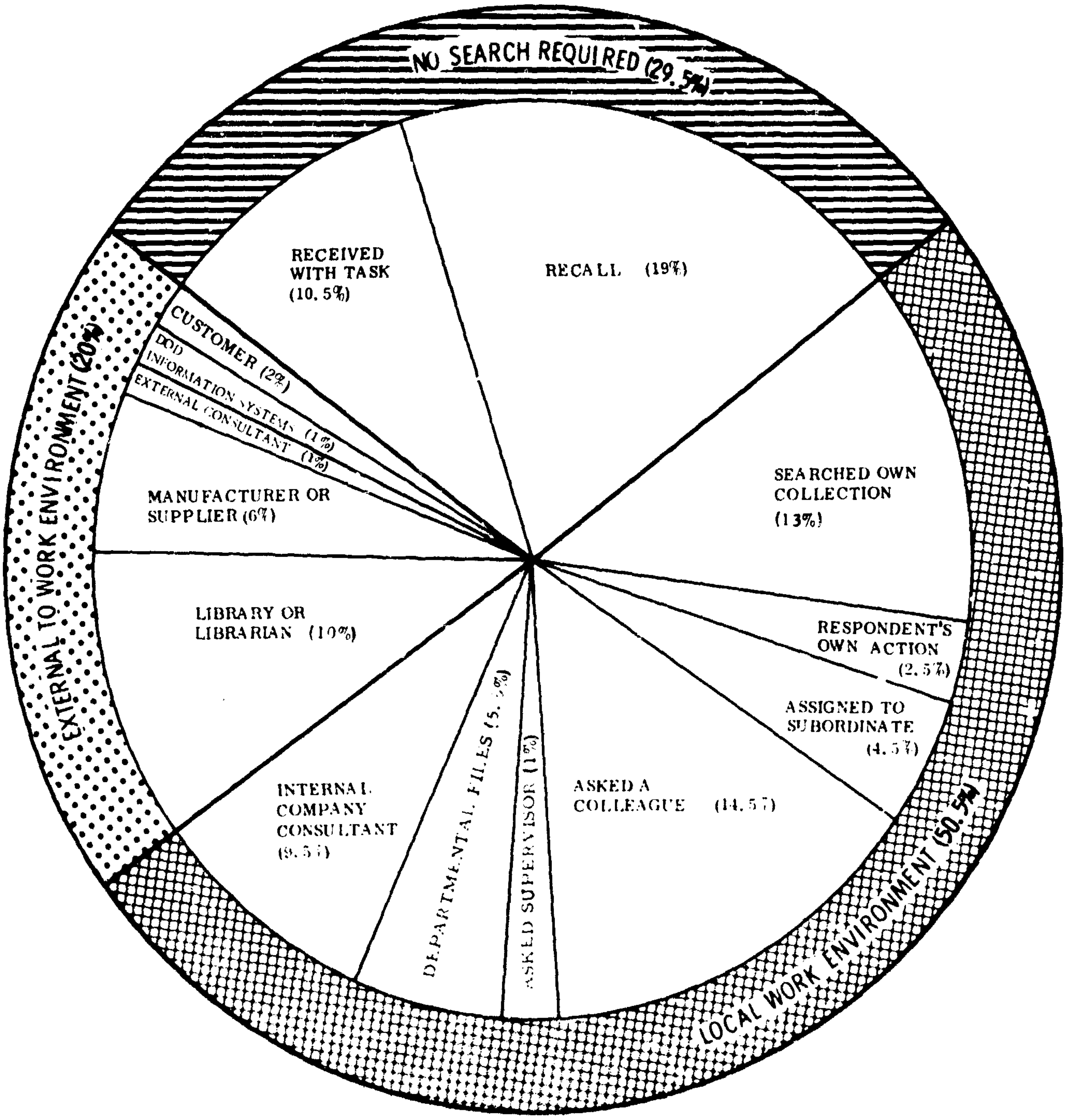


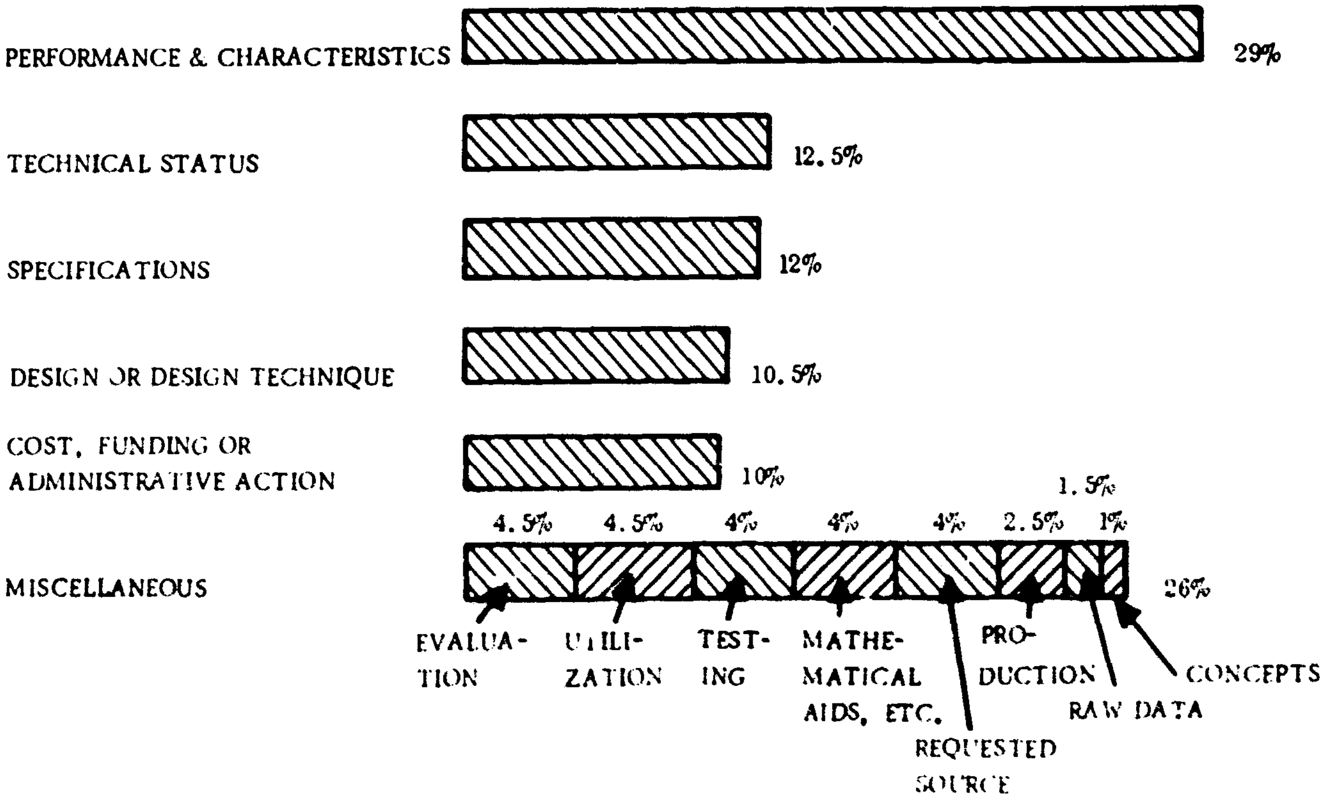
Figure 5-27. First Source Contacted for Information

The information desired from this first source was predominantly performance and characteristics information (29%), with technical status, specifications, design, and cost or administrative action also showing a significant influence (Figure 5-28).

The most frequent reasons for using a first source were that the source was readily available or easy to use, the information was known to be available from the source, or that source was the most authoritative known (see Figure 5-29). In 47% of the instances the first source supplied all of the information needed by the interviewee. Another 47% of the requests were successful in obtaining only part of the information. Of the remaining six percent, 4.5% were answered with a reference to another source and 1.5% were fruitless.

Time and Volume Characteristics

The time characteristics of the information chunks reflect the amount of time that could be allowed to acquire a unit of information (desired acquisition time) and the amount of time it actually took to receive it (actual acquisition time). The distributions for these two time factors are presented in Figures 5-30 and 5-31. One point of special interest is that 18.5% of the chunks were not required until 90 days or more after their definition as task requirements. With the exception of 5%, the information needs were satisfied within the desired acquisition time (Figure 5-32).



*The narrative answers to the question were categorized according to class, so that class of information (see Figure 5-45) would have a "desired" counterpart. This categorization was applied to only the answers that correspond to the first three information chunks.

Figure 5-28. Desired Class of Information*

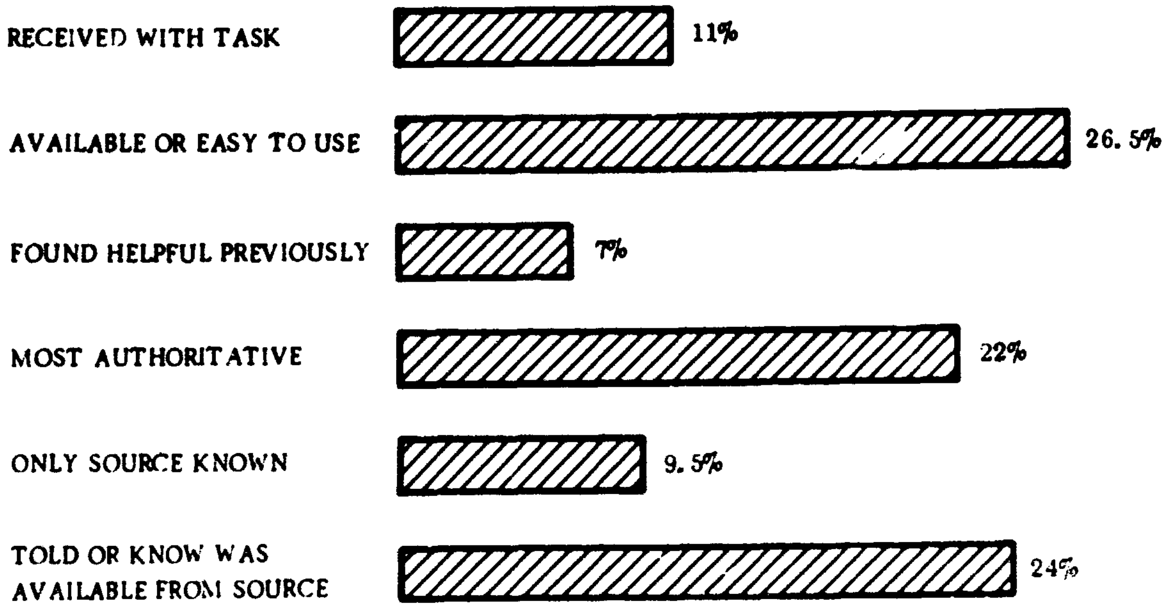


Figure 5-29. Why Used First Source for Information

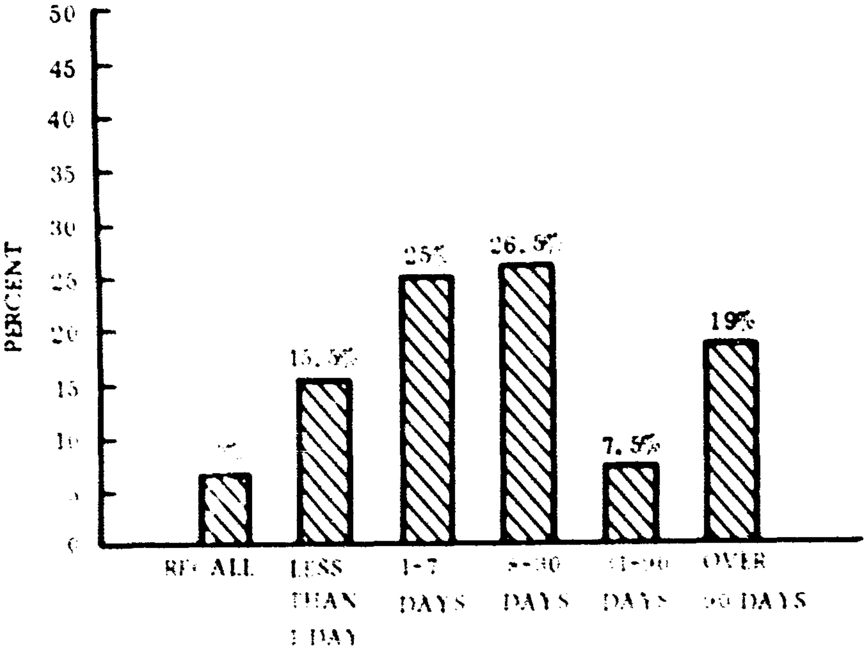


Figure 5-30. Desired Acquisition Time

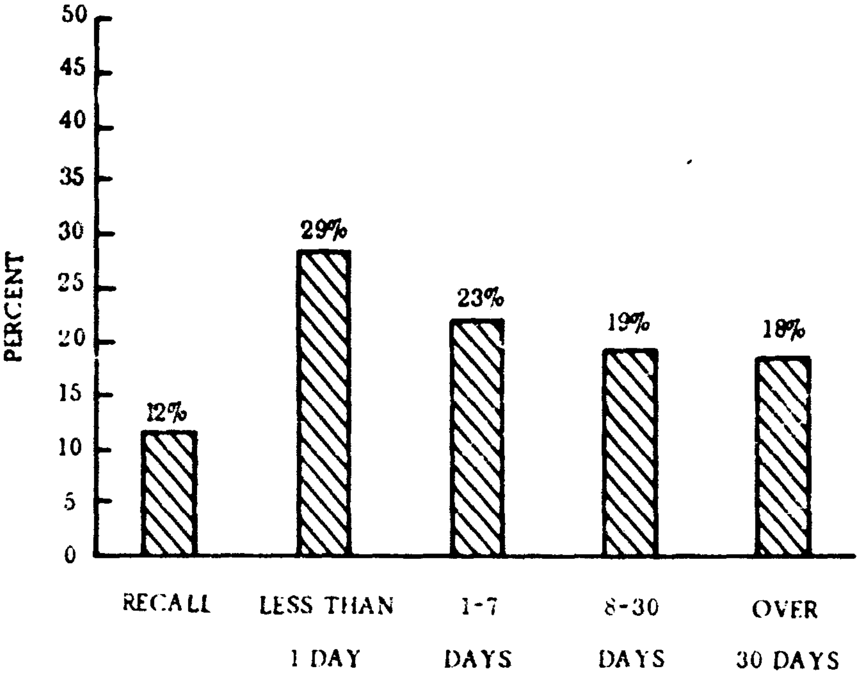


Figure 5-31. Actual Acquisition Time

Volume characteristics indicate the breadth or amount of the media which conveys the information. The greatest percentage (41%) desired to get all the reports and documents that could be found pertinent to the question (Figure 5-33). On the other hand, 38% of the interviewees actually received only a sampling of the available reports and documents (Figure 5-34). The actual volume was less than that desired in 14% of the cases (see Figure 5-35).

Form Characteristics

The form of the media by which the information chunks are transmitted is characterized by the composition and layout of the information media. The most desired media composition is that of oral contacts (24.5%); the document that was wanted the most is a report (15%) (see Figure 5-36). Only 3 percent of the information was received in a media that was not one of the regularly used ones for transmitting information to the user. There is little difference between the distributions of composition for the desired media in Figure 5-36 and the actual media in Figure 5-37. When transmitting media are grouped into the composition categories of oral, informal documentation, semiformal documentation and formal documentation, the oral (37%) and semiformal (34%) media dominate both the desired and actual media groupings (Figure 5-38).

The physical layout of the media break down into the basic groupings of recall, oral, graphics, narrative text, and their combinations. The desired and actual physical layouts were predominantly combinations of graphics and narrative text. See Figures 5-39 and 5-40.

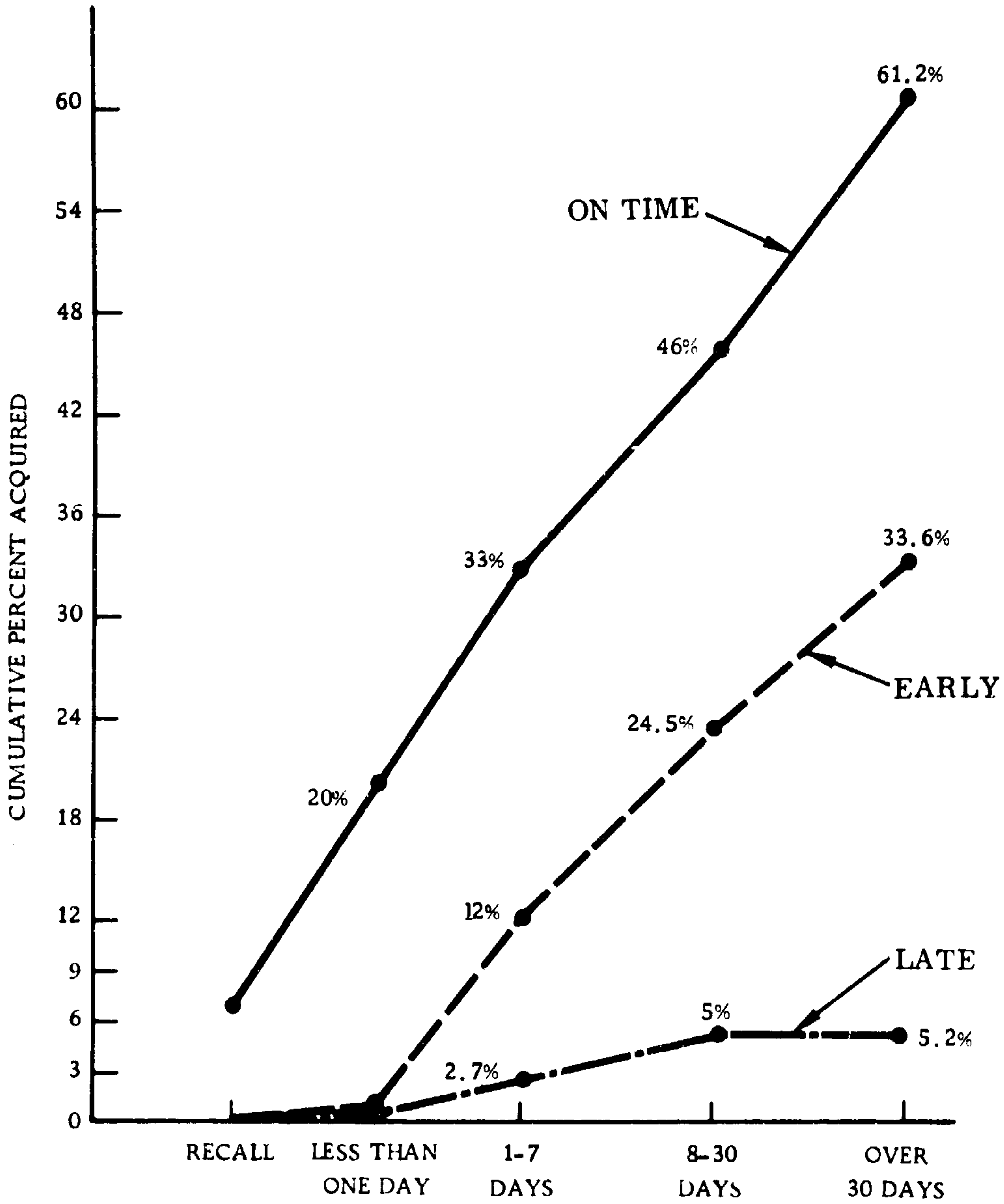


Figure 5-32. Timely Acquisition of Information

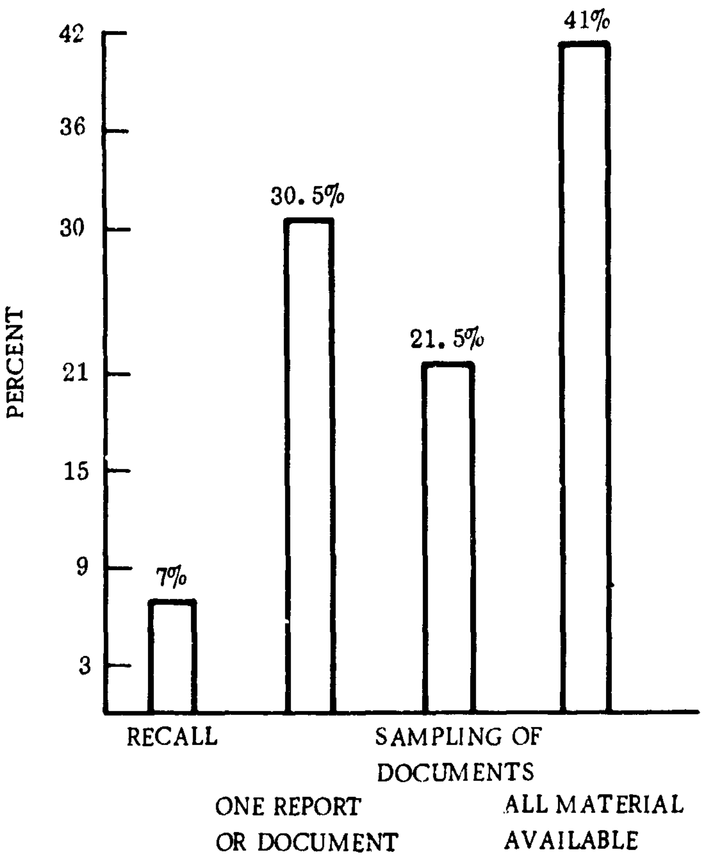


Figure 5-33. Desired Volume of Information Media

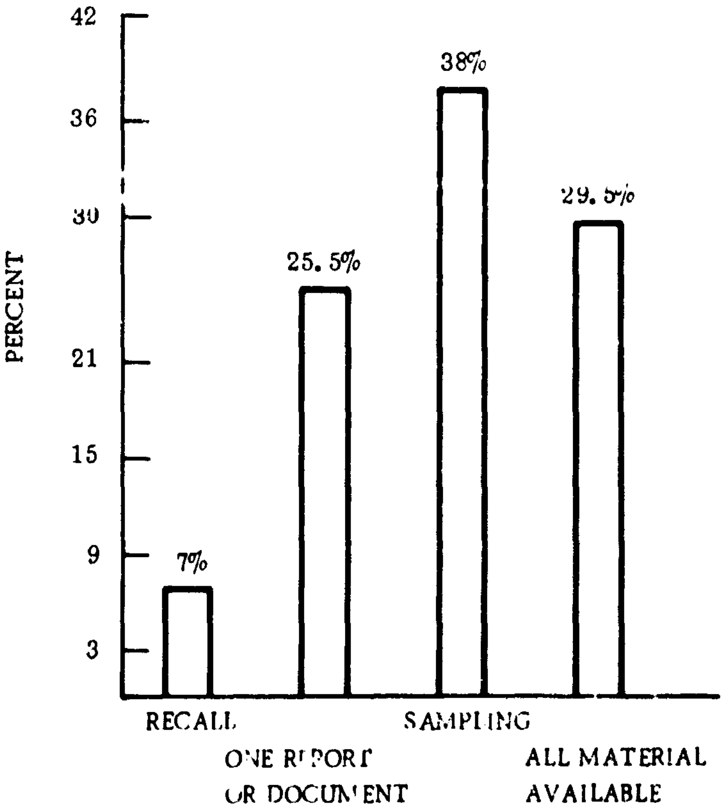


Figure 5-34. Actual Volume of Information Media

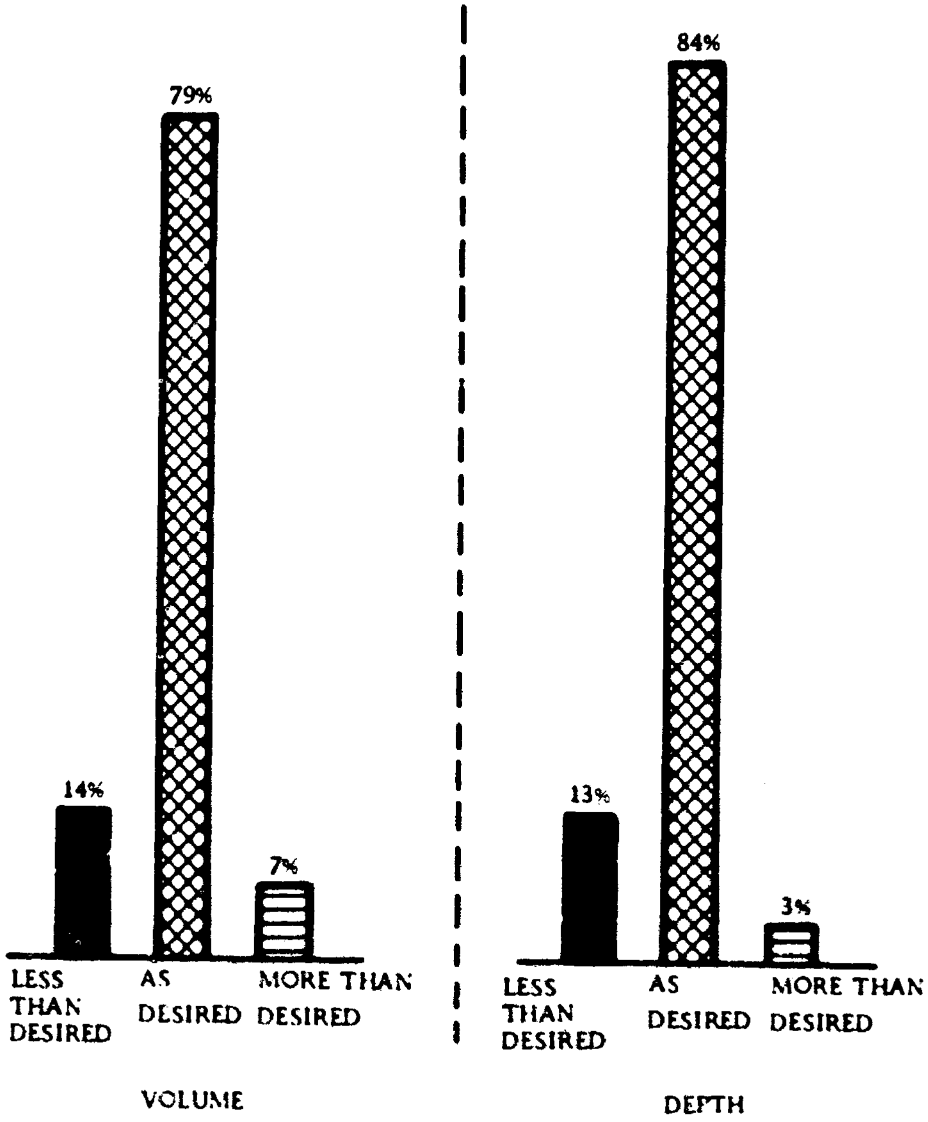


Figure 5-35. Volume and Depth of Information Media

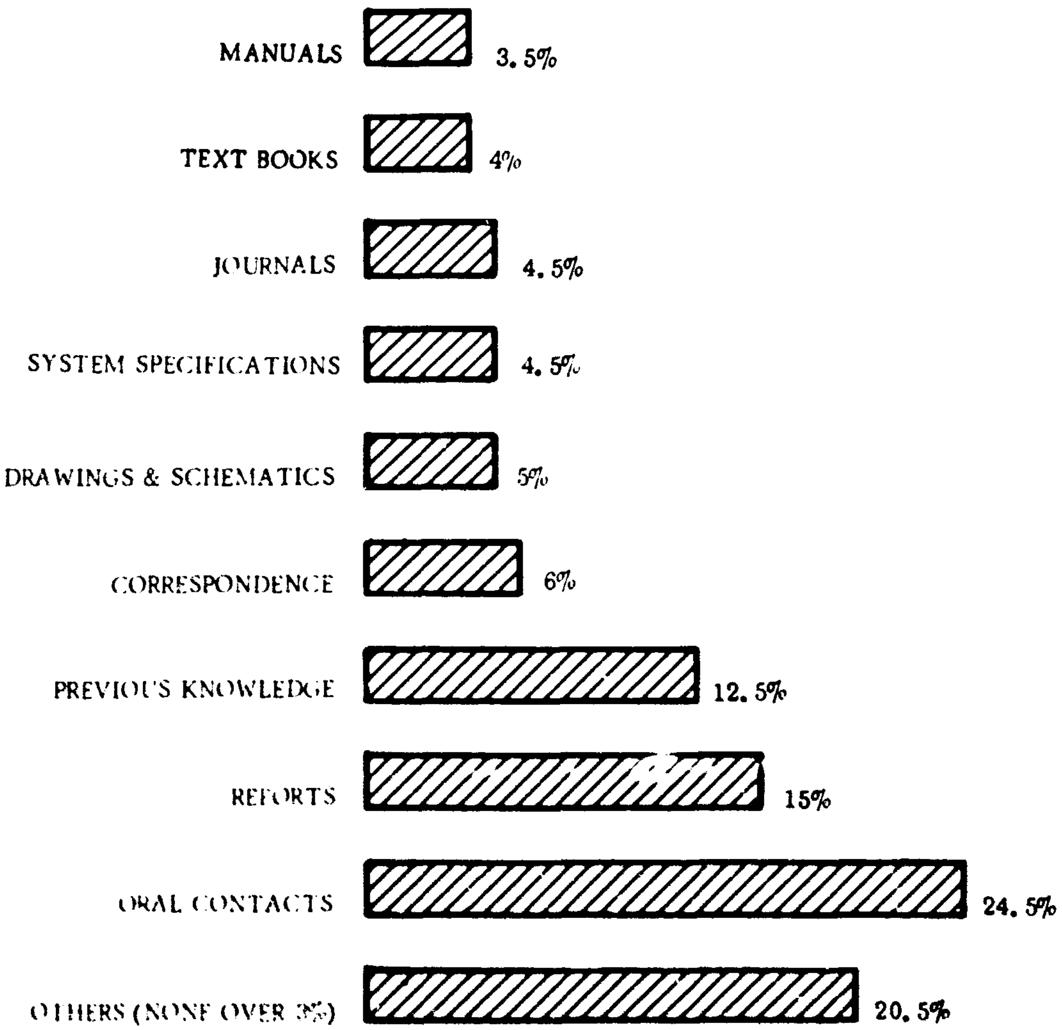


Figure 5-36. Desired Composition of Information Media

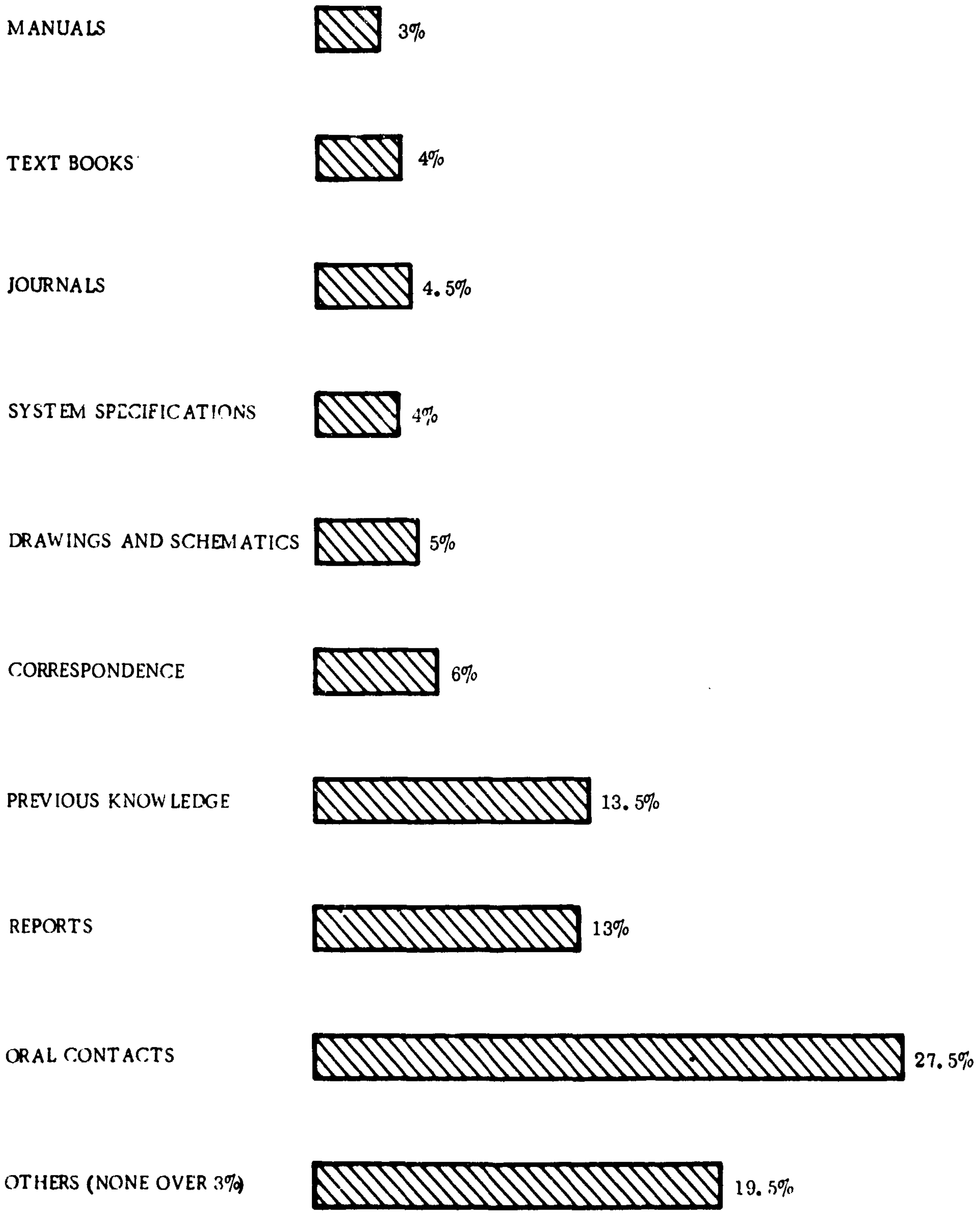
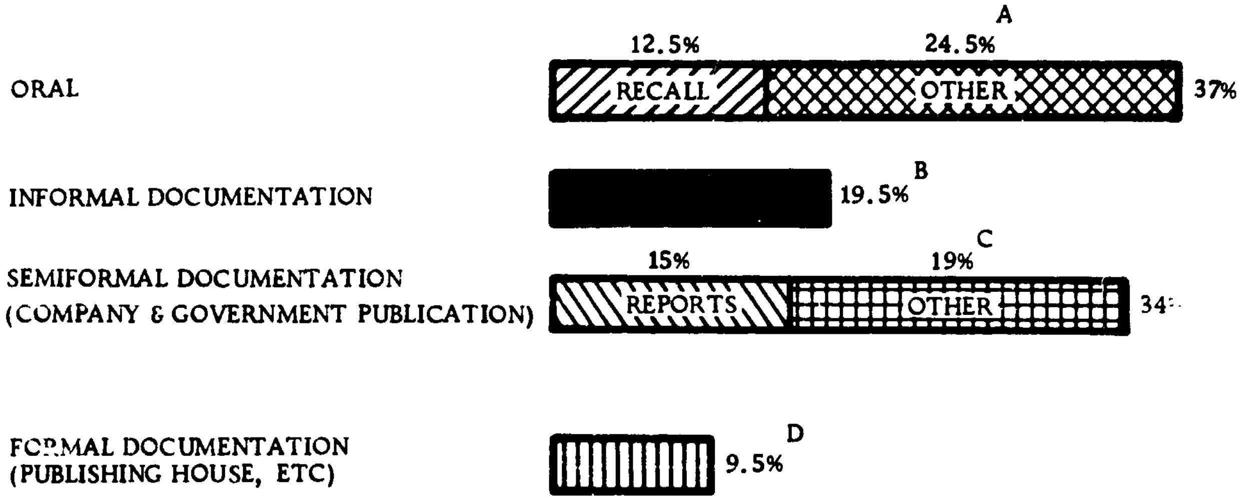


Figure 5-37. Actual Composition of Information Media



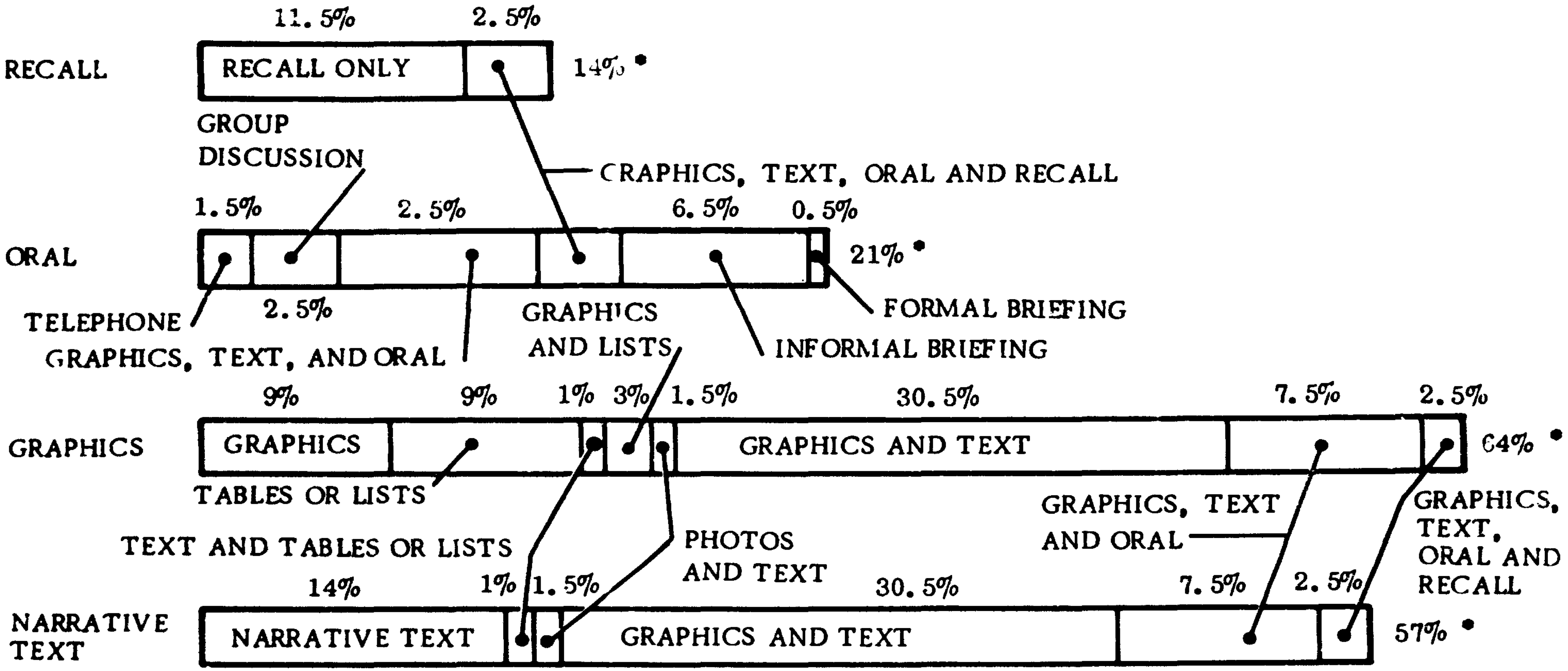
A. THOSE RESPONSES WITH OVER 3 PERCENT ARE: "ORAL CONTACTS-ALL OTHER" (18%) AND "ORAL CONTACTS WITH MANUFACTURER" (3.5%).

B. THOSE RESPONSES WITH OVER 3 PERCENT ARE: "PERSONAL NOTES, PERSONAL LOGS AND PERSONAL FILES" (3%); "CORRESPONDENCE, MEMOS AND TWX" (6%); AND "DRAWINGS AND SCHEMATICS" (5%).

C. THOSE RESPONSES WITH OVER 3 PERCENT ARE: "SYSTEM SPECIFICATION DOCUMENTS," (4.5%) AND "MANUALS" (3.5%).

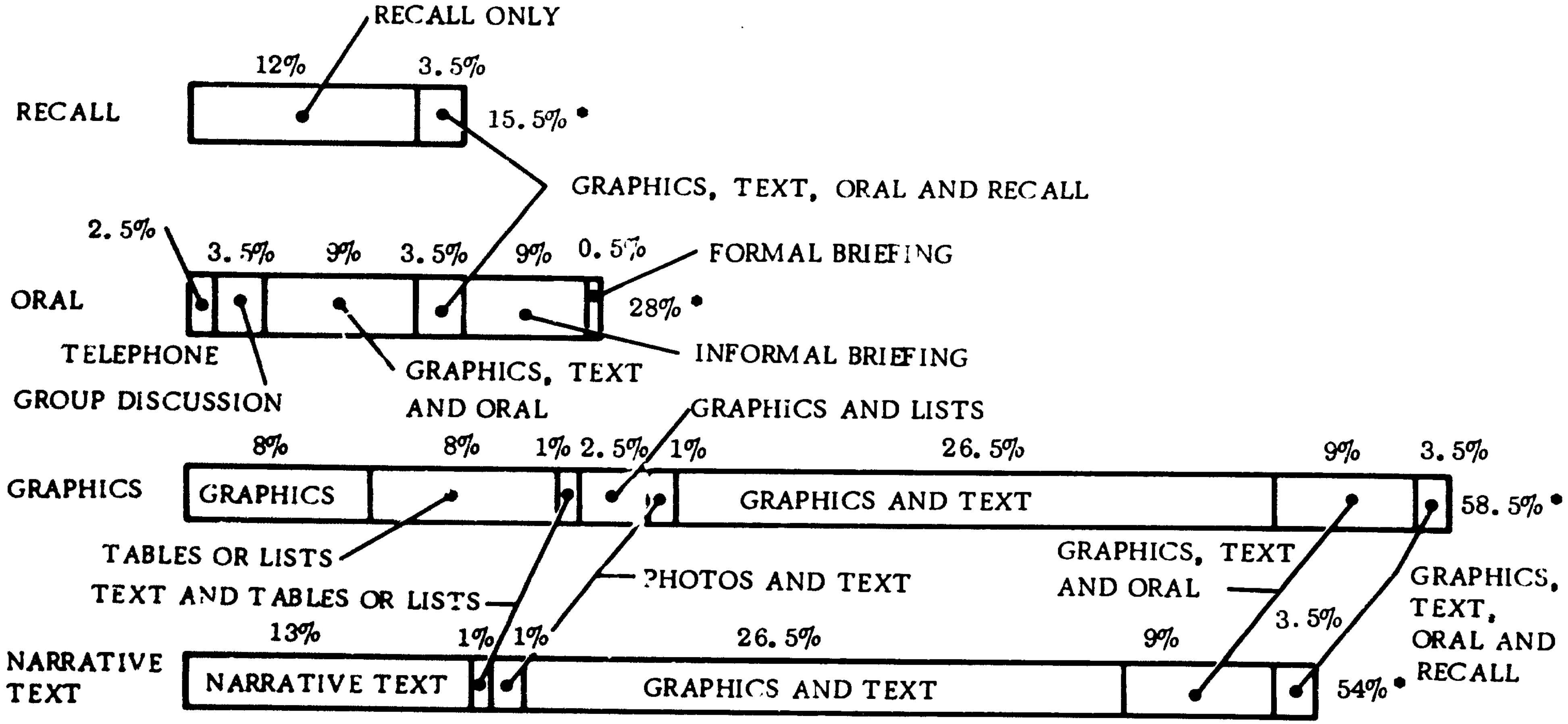
D. THOSE RESPONSES WITH OVER 3 PERCENT ARE: "JOURNALS" (4.5%) AND TEXTBOOKS" (3.5%).

Figure 5-38. Desired Composition of Information Media



*SINCE LAYOUTS WHICH ARE COMBINATIONS OF RECALL, ORAL, GRAPHICS AND NARRATIVE TEXT ARE PORTRAYED UNDER EACH APPLICABLE CATEGORY, THE SUM OF THE CATEGORY PERCENTS IS GREATER THAN ONE.

Figure 5-39. Desired Layout of Information Media



*SINCE LAYOUTS WHICH ARE COMBINATIONS OF RECALL, ORAL, GRAPHICS AND NARRATIVE TEXT ARE PORTRAYED UNDER EACH APPLICABLE CATEGORY, THE SUM OF THE CATEGORY PERCENTS IS GREATER THAN ONE.

Figure 5-40. Actual Layout of Information Media

Content Characteristics

The information content is defined by the depth or detail of the information media, value of the chunks to the task, and class and field of the information. The depth of information desired and actually received was a specific answer at least 50% of the time (Figures 5-41 and 5-42). Similar to volume, the actual depth was less than that desired in 13% of the cases (see Figure 5-35).

The value of the chunk to the task is expressed in how essential the information was, and the extent of its use in the performance of the task. Some 78% of the chunks were considered to be absolutely essential to the task (Figure 5-43).

The information was used throughout the entire task in 41% of the cases (Figure 5-44).

The information chunks were 62% design and performance by grouped class, with the specific class of performance and characteristics making up 25% of all information chunks (see Figure 5-45). The field of the information was 47.5% engineering and 38.5% scientific (Figure 5-46).

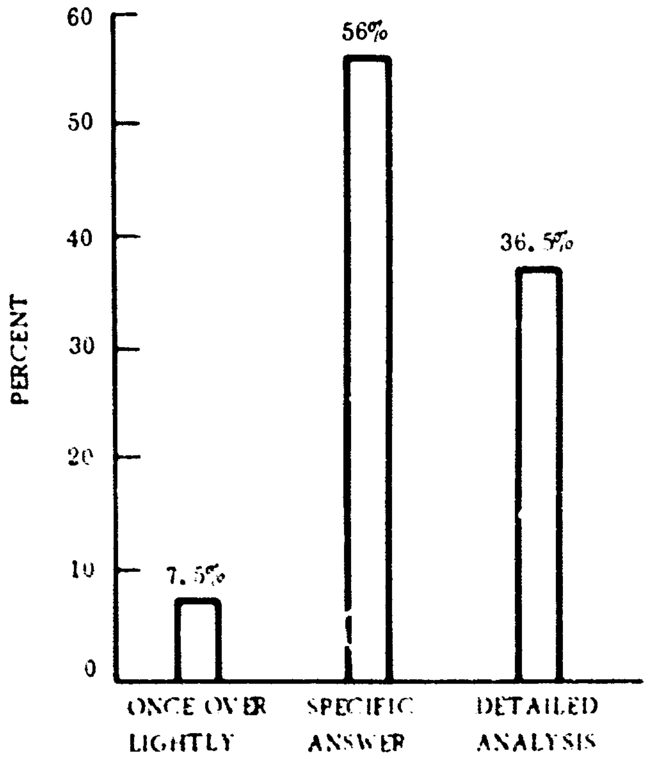


Figure 5-41. Desired Depth of Information Media

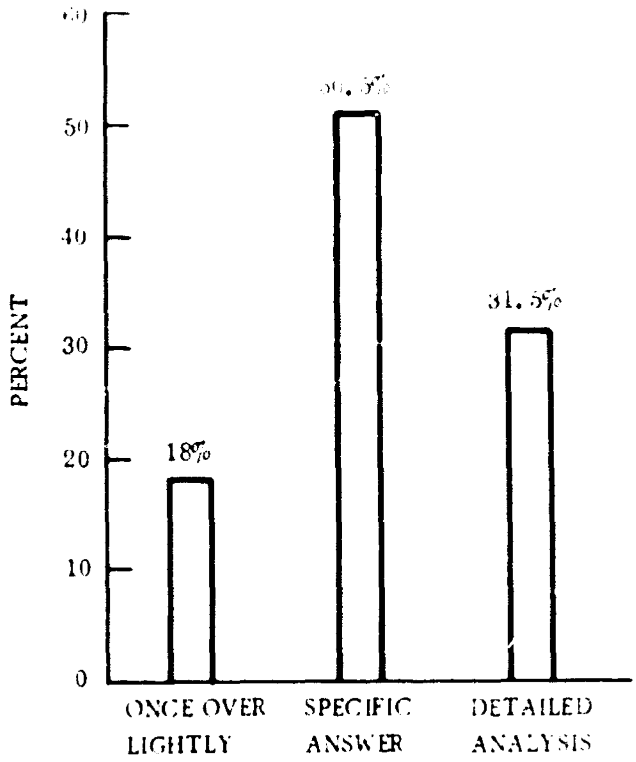


Figure 5-42. Actual Depth of Information Media

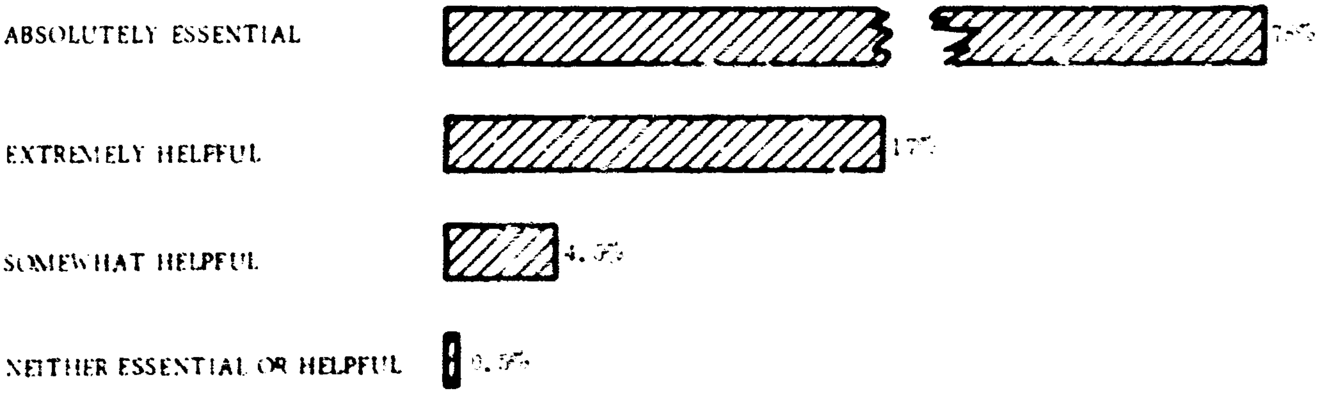


Figure 5-43. Essentiality of Information

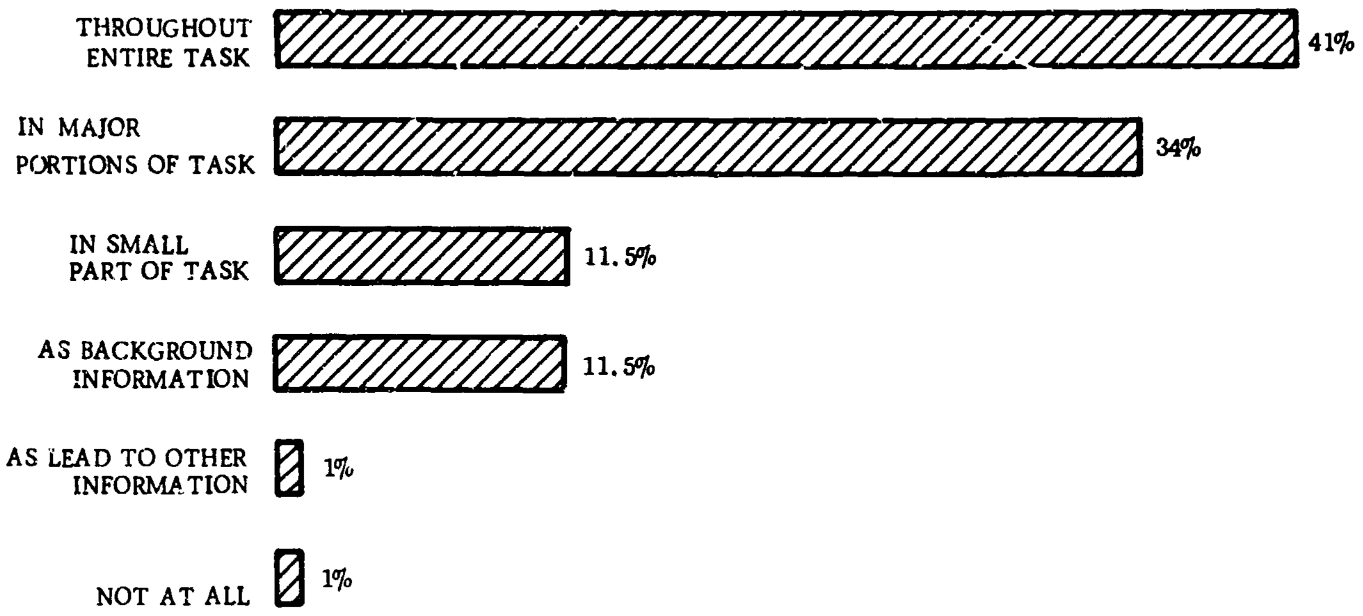


Figure 5-44. Extensiveness of Information Use

Title Listings and Abstracts

Another feature associated with the information chunks was the usefulness of title listings and abstracts in acquiring them. Title listings or abstracts were used in 23.5% of the search procedures. The respondents stated that although not used, they would have been useful for some 19.5% of the other chunks. However, this leaves some 57% of the information chunks for which title listings or abstracts would not have been appropriate or useful. The reasons given for title listings or abstracts not being useful for these chunks are presented in Figure 5-47.

Interviewer Assessments

At the completion of each interview, the interviewer was asked to answer four questions to indicate his assessment of the interview's content. The user's need for information that was external to his immediate environment was judged to be insignificant for 19.5% of the users and significant for 32%, with the remaining 48.5% having a moderate need.

Sixty-five percent of the tasks were assessed as requiring professional judgement in order to use the information received. Only 7% of the tasks involved information usage that required innovations, due to lack of established methods or procedures for using the information. Information acquisition procedures were judged to be neither clear nor obvious in 16% of the tasks and quite clear or obvious in 33% of them. The results of the fourth assessment, dealing with the creativity or unique contribution of the task, are presented in Figure 5-48.

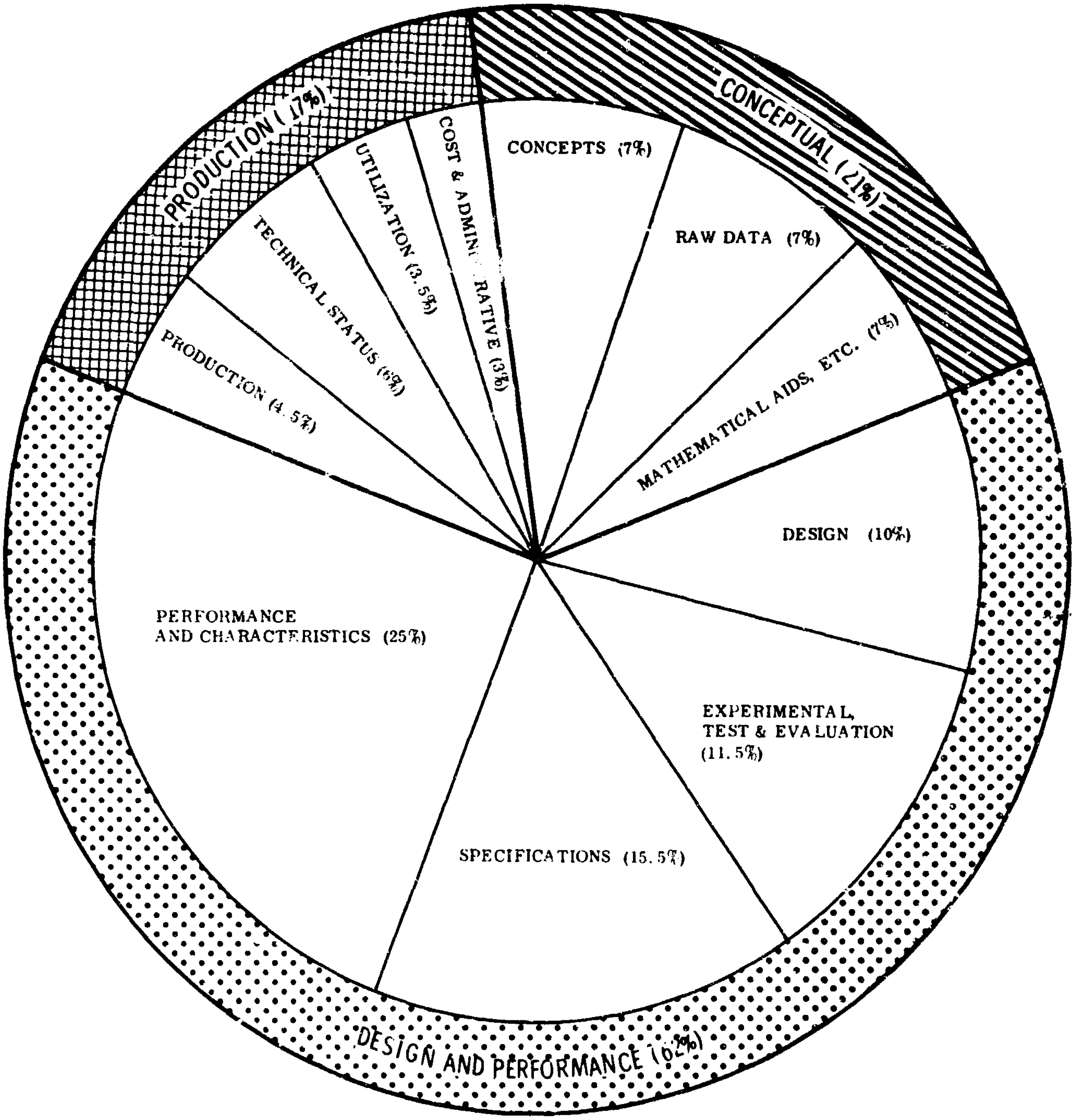


Figure 5-45. Class of Information

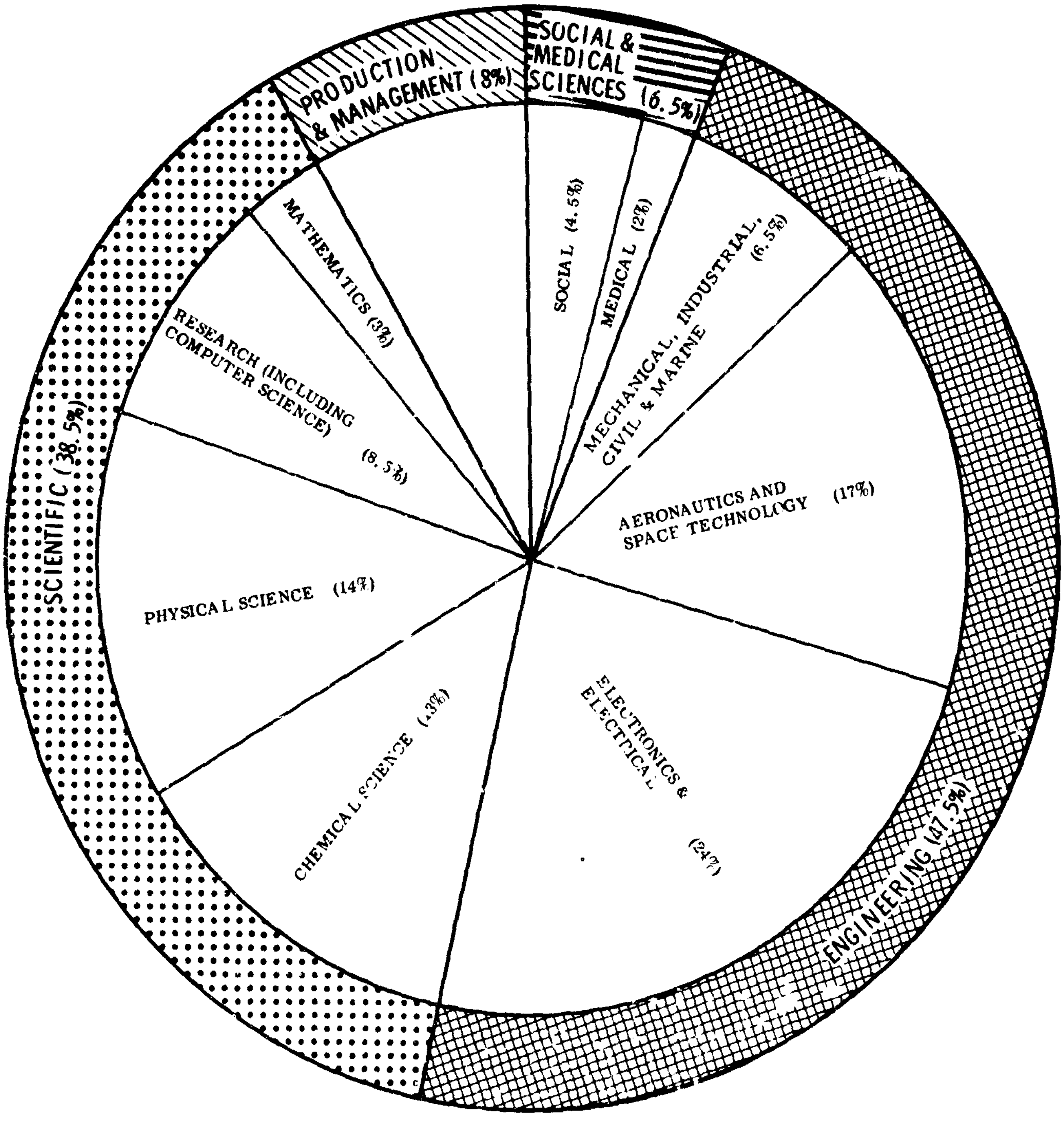


Figure 5-46. Field of Information

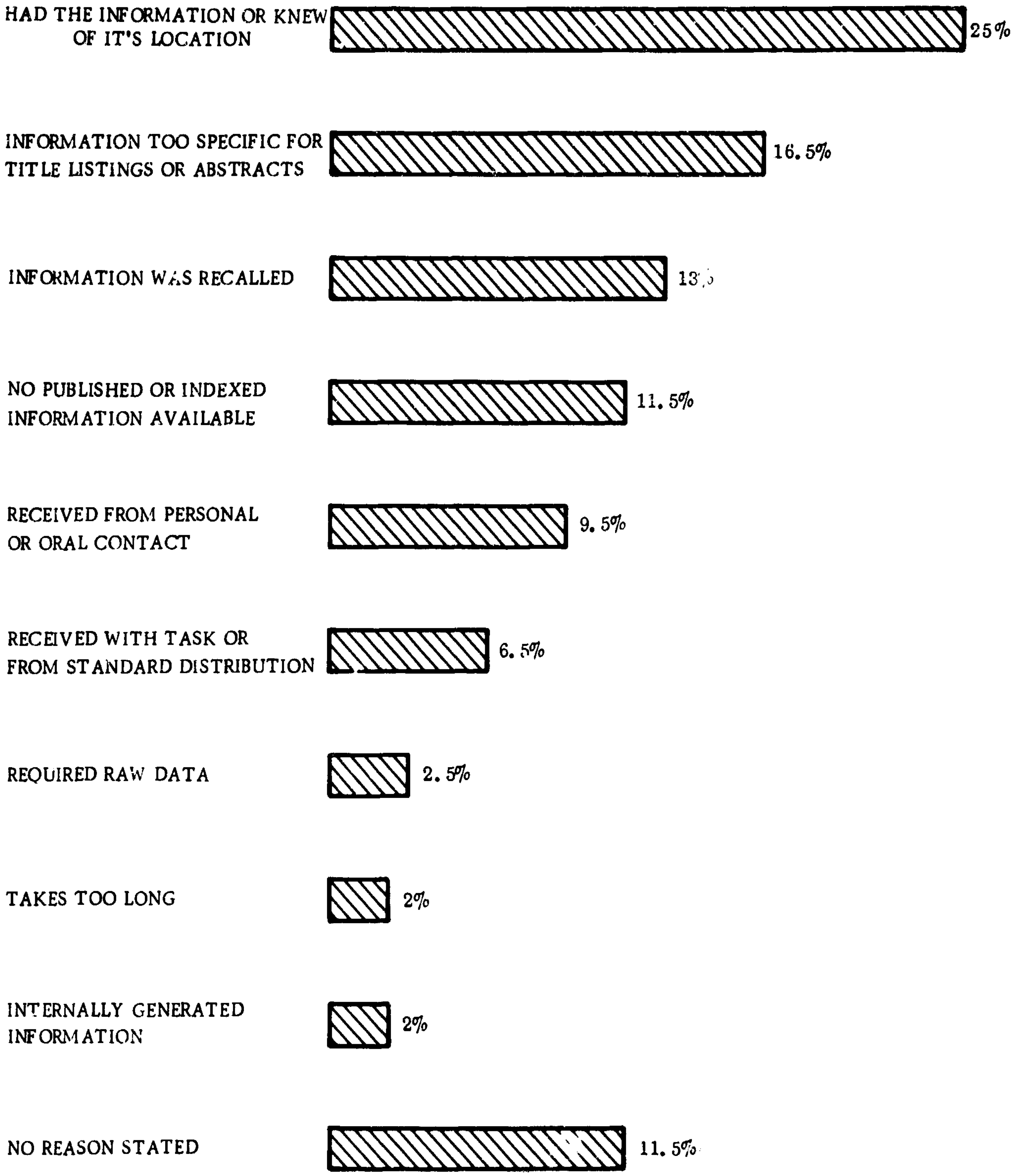


Figure 5-47. Reason for Title Listings or Abstracts Not Being Useful*

*Based on the narrative answers of the 3051 users who responded that Title Listings or Abstracts "would not have been useful."

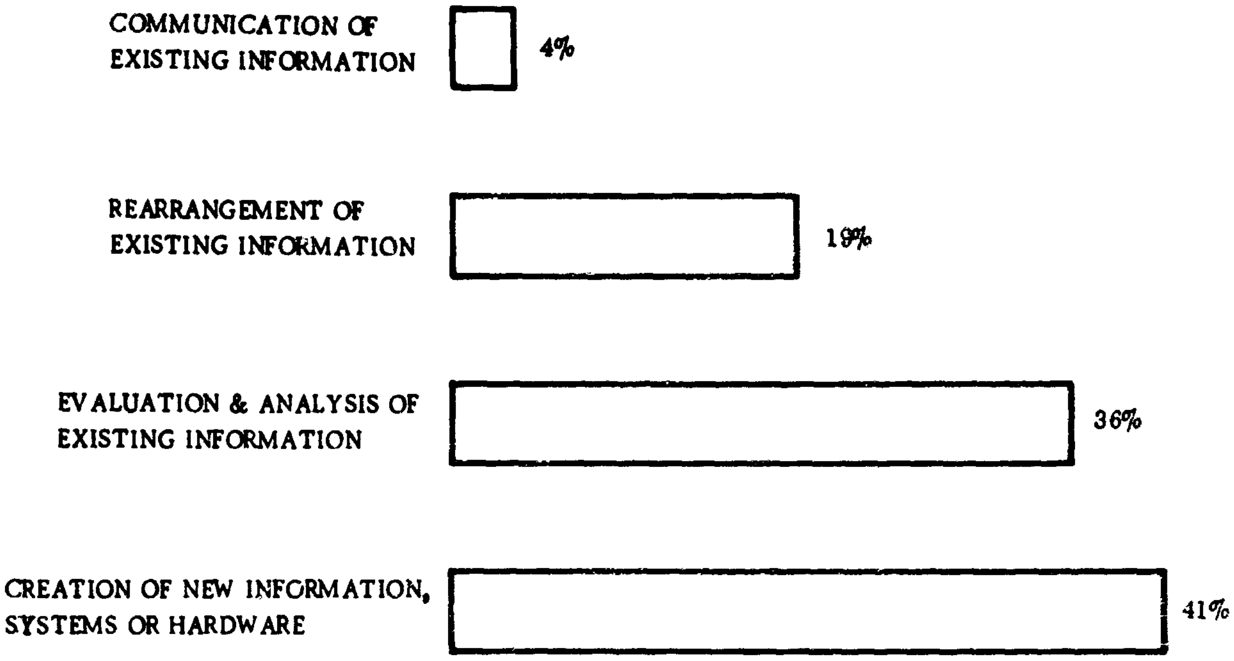


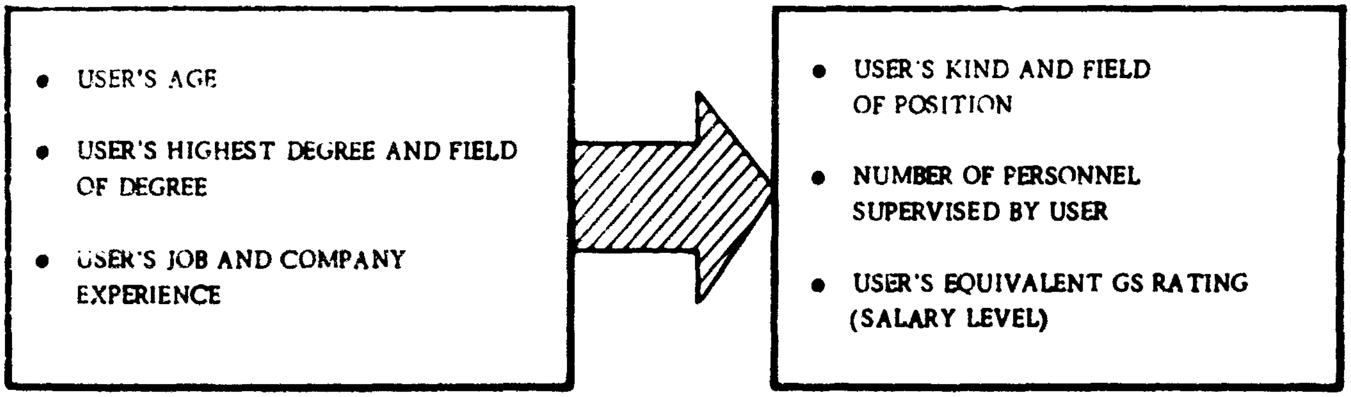
Figure 5-48. Interviewer Assessment of Task Creativity

5.3 TWO-WAY FREQUENCY DISTRIBUTIONS AND CORRELATIONS

Two-question interactions and their two-way frequency distributions are now described in terms of Chi-square (χ^2), the degrees of freedom (df) associated with χ^2, the probability (α) of χ^2 being exceeded if the questions were independent, the correlation (r) between the two questions, and significant distribution features. In order to determine the influence of the USER, TASK, UTILIZATION, and SEARCH AND ACQUISITION characteristics upon each other, 196 two-way frequency distributions were compiled; and a complete correlation matrix was constructed.

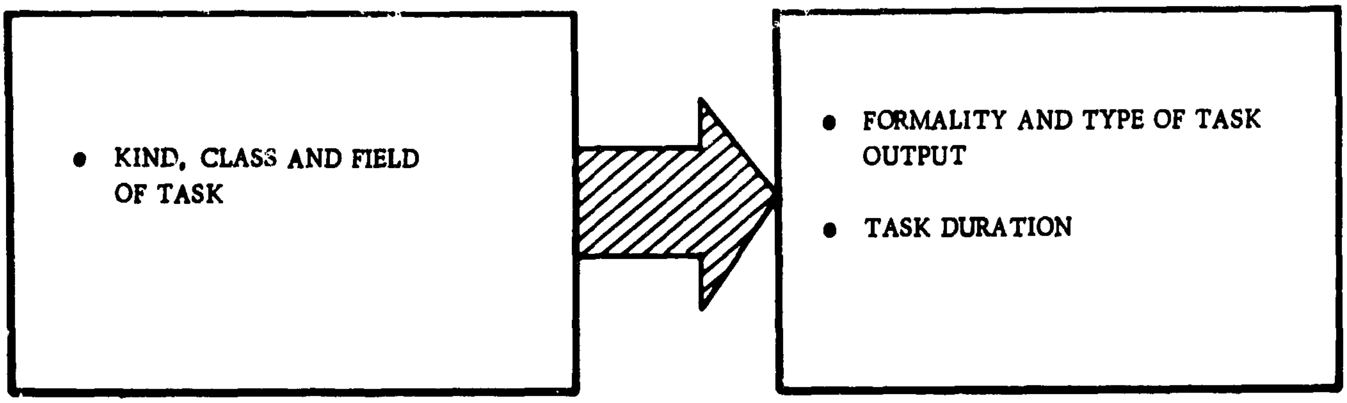
The interactions of interest are those that occur within profiles (e.g., between two USER characteristics), and those that occur between profiles (e.g., between a TASK characteristic and a USER characteristic). The former may be called intra-relations and latter may be called inter-relations. Figures 5-49 through 5-52 depict the intra-relations for the USER, TASK, UTILIZATION, and SEARCH AND ACQUISITION profiles; while Figure 5-53 depicts the four inter-relations for the flow process. The arrows in these figures point from the input (tending to influence) to the output (tending to be influenced) for the relations.

Table 5-4 lists 30 two-way frequency distributions which exhibit no significant interaction (i.e., independence). They are those distributions whose values of α are greater than .0005, which appears to be a reasonable boundary between "high" and "low" values of α.



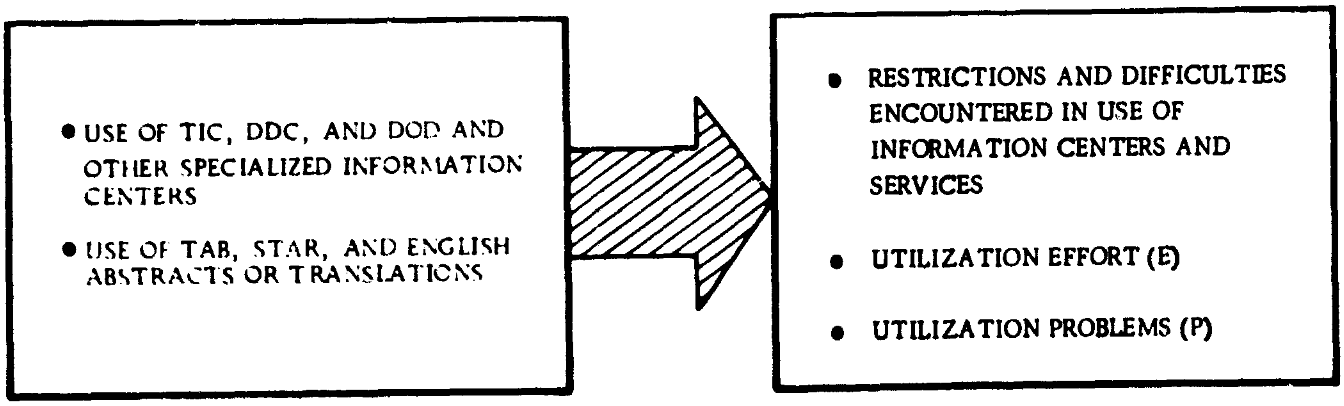
*The arrows point from input (tending to influence) to output (tending to be influenced).

Figure 5-49. Intra-Relations for the User of Scientific and Technical Information*



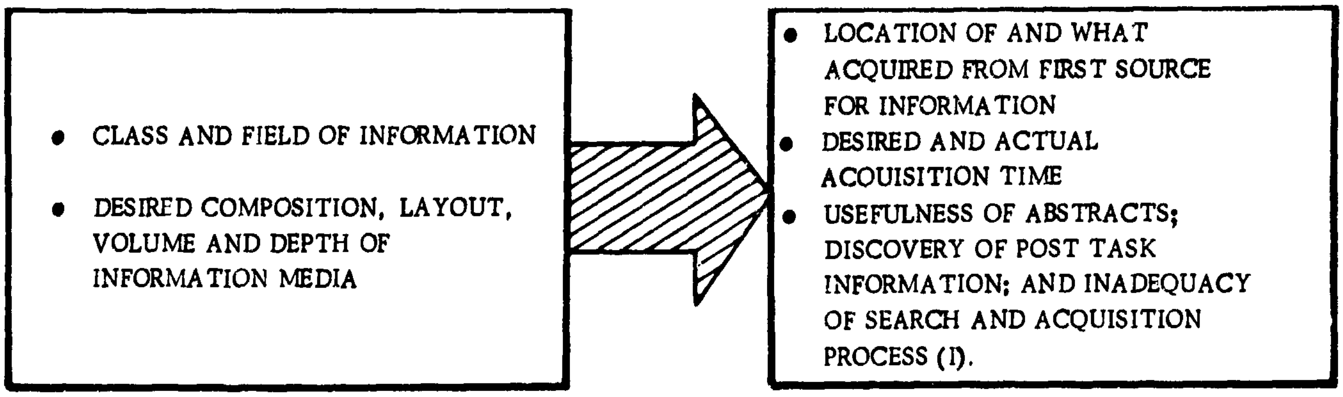
*The arrows point from input (tending to influence) to output (tending to be influenced).

Figure 5-50. Intra-Relations for the Scientific or Technical Task*



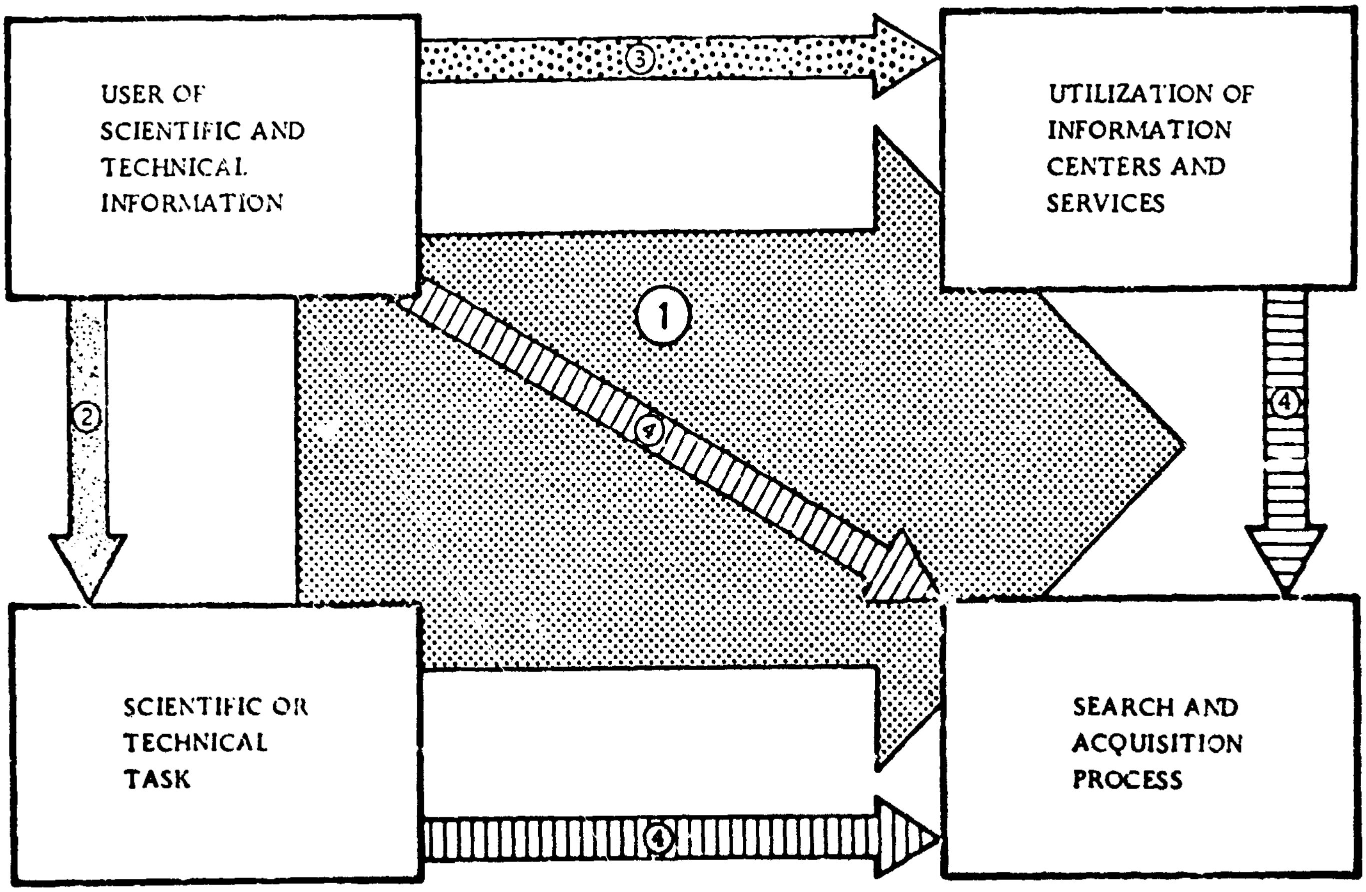
*The arrows point from input (tending to influence) to output (tending to be influenced).

Figure 5-51. Intra-Relations for the Utilization of Information Centers and Services*



*The arrows point from input (tending to influence) to output (tending to be influenced).

Figure 5-52. Intra-Relations for the Search and Acquisition Process*



***The arrows point from input (tending to influence) to output (tending to be influenced).**

Figure 5-53. Inter-Relations for the Flow Process*

Table 5-4. Two-Way Frequency Distributions Which Exhibit No Significant Interaction

Questions	Description	χ^2	df	α
USER vs TASK				
Q56 vs Q3	Field of Position vs Task Duration	91.68	64	$.01 < \alpha < .025$
USER vs UTILIZATION				
Q50C vs Q45	Field of Degree vs Encounter of Difficulties	18.39	13	$\alpha > .05$
Q55 vs Q46	Kind of Position vs Nature of Difficulties	26.30	22	$\alpha > .05$
Q56 vs Q37	Field of Position vs Use of Technical Abstract Bulletin	51.86	32	$.01 < \alpha < .025$
Q56 vs Q43	Field of Position vs Nature of Restrictions	27.03	16	$.01 < \alpha < .025$
Q56 vs Q45	Field of Position vs Encounter of Difficulties	15.68	8	$.025 < \alpha < .05$
Q56 vs Q46	Field of Position vs Nature of Difficulties	18.52	16	$\alpha > .05$
Q54 vs Q41	Type of Activity vs Use of Other Specialized Information Centers	8.90	4	$\alpha > .05$
Q54 vs Q42	Type of Activity vs Encounter of Restrictions	14.32	4	$.005 < \alpha < .01$
USER vs SEARCH AND ACQUISITION				
Q55 vs Q32	Kind of Position vs Discovery of Post Task Information	14.61	11	$\alpha > .05$
Q56 vs Q32	Field of Position vs Discovery of Post Task Information	3.64	8	$\alpha > .05$
Q58 vs Q32	Equivalent Government Service Rating vs Discovery of Post Task Information	10.71	11	$\alpha > .05$
Q54 vs Q32	Type of Activity vs Discovery of Post Task Information	9.85	4	$.025 < \alpha < .05$
TASK vs TASK				
Q3 vs Q10	Task Duration vs Field of Task	108.99	64	$\alpha < .0005$
Q10 vs Q63	Field of Task vs Interviewer Assessment of Task Creativity	51.89	24	$.0005 < \alpha < .001$
TASK vs SEARCH AND ACQUISITION				
Q3 vs Q25	Task Duration vs Desired Depth of Information Media	22.41	16	$\alpha > .05$
Q9 vs Q32	Kind of Task vs Discovery of Post Task Information	23.05	11	$.01 < \alpha < .025$
Q10 vs Q22	Field of Task vs Desired Volume of Information Media	47.27	24	$.001 < \alpha < .005$
Q10 vs Q32	Field of Task vs Discovery of Post Task Information	3.93	8	$\alpha > .05$
Q10 vs Q62	Field of Task vs Interviewer Assessment of Difficulty in Acquisition of Information	28.59	16	$.025 < \alpha < .05$

Table 5-4. (Cont)

Questions	Description	χ^2	df	α
UTILIZATION vs UTILIZATION				
Q35 vs Q43	Use of Company TIC vs Nature of Restrictions	12.39	6	$\alpha > .05$
Q35 vs Q46	Use of Company TIC vs Nature of Difficulties	7.77	6	$\alpha > .05$
Q37 vs Q46	Use of TAB vs Nature of Difficulties	10.45	8	$\alpha > .05$
Q39 vs Q46	Use of DDC vs Nature of Difficulties	4.02	4	$\alpha > .05$
SEARCH AND ACQUISITION vs SEARCH AND ACQUISITION				
Q16 vs Q32	Desired Class of Information vs Discovery of Post Task Information	9.70	13	$\alpha > .05$
Q29 vs Q24	Field of Information vs Actual Depth of Information Media	28.49	16	$.025 < \alpha < .05$
Q25 vs Q32	Desired Depth of Information Media vs Discovery of Post Task Information	12.39	2	$.001 < \alpha < .005$
Q25 vs Q61	Desired Depth of Information Media vs Interviewer Assessment of Difficulty in Use of Information	23.62	6	$.0005 < \alpha < .001$
Q20 vs Q32	Desired Composition of Information Media vs Discovery of Post Task Information	43.58	26	$.01 < \alpha < .025$
Q13 vs Q19	Desired Acquisition Time vs Usual Composition of Information Media	18.56	10	$.025 < \alpha < .05$

The most significant two-question interactions are commented upon below. For the reader's convenience, the description of appropriate two-way frequency distributions is augmented by the presentation of the complete correlation matrix in partitioned form. A more complete summary of two-way frequency distributions is contained in Appendix 14 of Volume II. All 196 two-way frequency distributions and the complete correlation matrix appear in Volume III.

Interaction of Kind, Class, and Field

Before embarking on the analysis of the two-way interactions, one should understand the internal structure and interaction of kind, class, and field. These elements are used in classifying task descriptions, information descriptions, and position or education descriptions for the individuals interviewed.

Kind of position (or task) is structured according to the research, development, and production cycle, beginning with basic research and ending with customer relations. This may be viewed in terms of an increasing "distance from nature," or from the scientific through the technical to the public.

Class of task (or information) is ordered according to the conceptual, design and performance, and production cycle, beginning with concepts and ending with cost, funding and administrative action. This too may be viewed in terms of an increasing "distance from nature," or from the scientific through the technical to the public.

Field of position (task or information) is arranged according to the production, social sciences, engineering and scientific cycle, beginning with production and management and ending with mathematics. This may be viewed in terms of an increasing "distance from the public" or degree of rigorous and structured abstract thought. In a loose sense, this is the reverse of the order for kind and class, in that it goes from the public through the technical to the scientific. Field of highest degree is similarly, but not identically, structured.

Since the elements of kind, class, and field are common descriptors in two or three of the four profiles, they occupy a unique position in inter-relations. Each of these elements in a particular profile has an intra-relation to the other elements of that profile. In addition, there are inter-relations established between the similar elements (kind, class, and field) of the different profiles. This between profile interaction of kind, class, or field can influence the between profile interactions of other elements. That is, if kind of task has a pattern of intra-relations within the TASK profile and a strong inter-relation to kind of position, then this inter-relation between kind of position and kind of task may be reflected in the interactions of kind of position and other TASK profile elements. Therefore, it is necessary to be aware of the basic relations among these multiprofile descriptors.

Table 5-5 presents the correlation matrix for the kind, class, and field descriptors. There is a strong interaction between kind of position and kind of task, as well as among field of position, field of task, field of information, and field of highest degree. The class of task and class of information inter-relation is much weaker, but is still of sufficient strength to influence other interactions. By observing the interactions among these items as portrayed in Table 5-5, this between profile influence can be demonstrated. These relations, all of which involve some aspect of scientific or technical complexity, will evolve as having a common influence on many of the study variables.

Table 5-5. Kind, Class, and Field Correlation Matrix

		KIND		CLASS		FIELD			
		Position (Q55)	Task (Q9)	Task (Q8)	Info. (Q28)	Position (Q56)	Highest Degree (Q50C)	Task (Q10)	Info. (Q29)
KIND	User's Position (Q55)	1.000	.660	.207	.117	-.199	-.230	-.170	-.181
	Task (Q9)			.181	.114	-.135	-.173	-.133	-.132
CLASS	Task (Q8)				.178	-.160	-.046	-.142	-.142
	Information (Q28)					-.111	-.069	-.091	-.206
FIELD	User's Position (Q56)						.300	.696	.515
	User's Highest Degree (Q50C)							.240	.190
	Task (Q10)								.588
	Information (Q29)								1.000

USER Profile

The user of scientific and technical information in the defense industry is described in this study by his age, education, work experience, position descriptors and employment level. The elements which make up the USER description are highly related, as would be expected for the population sampled. For example, age is highly correlated with years of job experience in a particular field, years of company experience, equivalent GS rating (salary level), type of activity, and the number of personnel supervised. The only USER elements that are not influenced by age are field of position and highest degree. (See Table 5-6.)

Within the USER profile a descriptive grouping contains equivalent GS rating (salary level), highest degree, kind of position, and type of activity. The characteristics making up this grouping are an indication of the user's level or worth to the company, and act as the composite influencer of the USER on other profiles.

The more informative two-way frequency distributions involving USER intra-relations are summarized in Table 5-7.

TASK Profile

The most outstanding intra-relation of TASK descriptors is between the formality of task output and the recipient of task output. In essence, as the task output is directed to individuals or organizations farther removed from the interviewee (e.g., outside the company), it is presented in a more formal manner (Figure 5-54)1. Task initiator is related to the percentage of time devoted to the task, the formality of its output, and the kind of task. This indicates that tasks initiated by an individual and/or his colleagues tend to be less formal, research oriented, and have a smaller proportion of work time allotted to them. In addition, there is a tendency for the more technical tasks to be longer in duration than other tasks (see Figure 5-55). High task creativity is associated with tasks that are longer, are research oriented, have a conceptual output, and are directed to sources outside the company.

The TASK correlation matrix is contained in Table 5-8. Table 5-9 then presents a summary of significant TASK intra-relations that were exhibited by the two-way frequency distributions.

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[1] For the discussion in this section, each two-way frequency distribution focuses attention upon one question, and presents both the marginal distribution of answers to that question, and the conditional distribution of answers to a second question for each response to the first question. Figure 5-54, for example, focuses attention upon task recipient as the first question, with formality of task output being the second question. The marginal one-way distribution of percentages for task recipient responses are presented in the left margin of the table, while a conditional one-way distribution of percentages (i.e., the proportion of those individuals that answered a particular task recipient response, who answered each formality of task output response) is presented in the table for each formality of task output response. The usual two-way frequency distribution for task recipient vs. formality of task output may be obtained by multiplying each formality of task output conditional percentage by the appropriate marginal task recipient percentage.

Table 5-6. USER Correlation Matrix

	(Q50A) Highest Degree	(Q50C) Field of Degree	(Q50B) Year of Degree	(Q51) Job Experience	(Q52) Company Experience	(Q55) Kind of Position	(Q56) Field of Position	(Q58) Equivalent GS Rating	(Q49) Number of Personnel Supervised	(Q54) Type of Activity
User's Age (Q48)	-.021	-.124	-.786	.576	.517	.034	-.114	.438	.189	.193
Highest Degree (Q50A)		.545	.359	-.026	-.119	-.393	.097	.434	.029	.112
Field of Degree (Q50C)			.314	-.071	-.113	-.230	.300	.205	-.004	.058
Year of Degree (Q50B)				-.552	-.495	-.155	.140	-.287	-.152	-.127
Job Experience (Q51)					.351	-.053	-.084	.357	.163	.125
Company Experience (Q52)						.140	-.098	.255	.205	.251
Kind of Position (Q55)							-.199	-.214	.093	.042
Field of Position (Q56)								-.021	-.127	-.116
Equivalent GS Rating (Q58)									.412	.438
Number of Personnel Supervised (Q49)										.600

Table 5-7. Significant USER Intra-Relations

Questions	Description	χ^2	df	α	r	Remarks
Q50A vs Q50C	User's Highest Degree vs. Field of Degree	1900.54	65	$\alpha < .0005$	.545	In general, the more abstract or further from the public the degree field, the higher the degree. a. Physical science: high proportion of doctor's degrees. b. Chemistry: high in respondents with doctor's degrees. c. Mechanical Engineering: high in bachelor's degrees. d. Civil engineering: high in bachelor's degrees. e. Biological and medical sciences: a high proportion of doctor's degrees. f. Behavioral and social sciences: high in master's degrees.
Q50A vs Q58	Highest Degree vs. Equivalent GS Rating	447.42	55	$\alpha < .0005$	.434	There is a strong tendency for persons with higher degrees to make more money. Highest Degree — GS — % Doctor's — GS-14 (14,000 - 16,499) — 28 GS-15 (16,500 - 18,999) — 23 GS-16 (19,000 - 20,999) — 10 GS-17 (21,000 - 23,999) — 11 Professional — GS-15 (16,500 - 18,999) — 35 GS-16 (19,000 - 20,999) — 23 Master's — GS-14 (14,000 - 16,499) — 24 GS-15 (16,500 - 18,999) — 19 GS-13 (12,000 - 13,999) — 19 GS-12 (10,250 - 11,999) — 14 Bachelor's — GS-12 (10,250 - 11,999) — 23 GS-13 (12,000 - 13,999) — 21 GS-11 (8,000 - 10,249) — 20 GS-14 (14,000 - 16,499) — 19 Associate's — GS-12 (10,250 - 11,999) — 36 GS-11 (8,000 - 10,249) — 36 No Degree — GS-11 (8,000 - 10,249) — 36 GS-12 (10,250 - 11,999) — 26 GS-13 (12,000 - 13,999) — 20
Q50A vs Q55	Highest Degree vs Kind of Position	621.89	55	$\alpha < .0005$	-.393	Strong tendency for persons working closer to nature to have the higher degrees. a. Applied and basic research: a high proportion of doctor's degrees. b. Advanced development: high proportion of master's degrees. c. Production processes: high in respondents with no degree.
Q50C vs Q55	Field of Degree vs. Kind of Position	732.20	143	$\alpha < .0005$	-.230	Although there are no distinct patterns, the following features are of interest: a. No degree: a high proportion in R&D support, test or evaluation, production processes, and production end-items; and a low proportion in basic and applied research, system analysis and advanced development. b. Behavioral and social sciences: a high proportion performing R&D support and system analysis, and a low proportion in advanced and engineering development.

Table 5-7. (Cont)

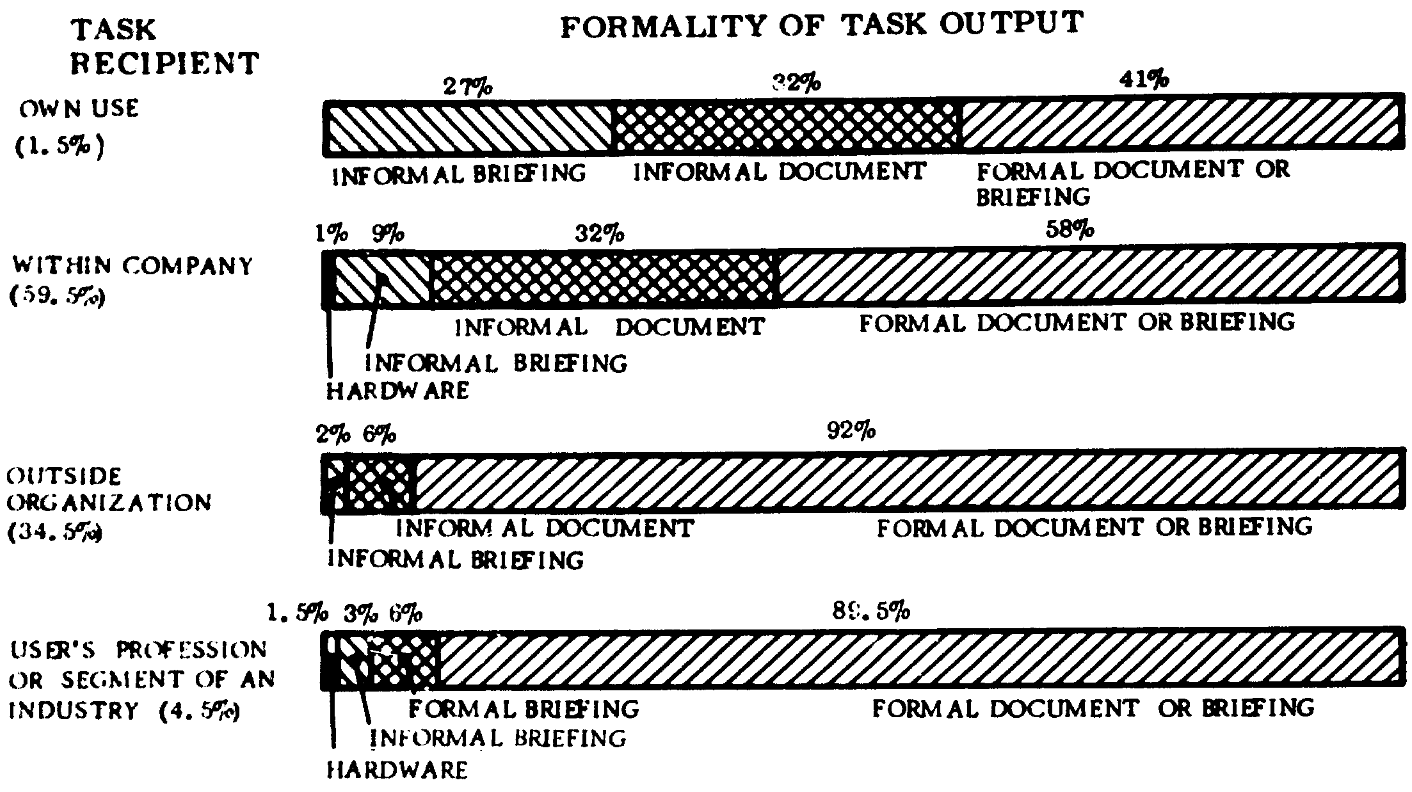
Questions	Description	χ^2	df	α	r	Remarks
Q50C vs Q55 (Cont)						c. Biological and medical sciences: a high proportion in basic and applied research and R&D support, and a low proportion in all other kinds of position. d. General engineering: a high proportion in system analysis; and a low proportion in basic research, and advanced development. e. Civil engineering: a high proportion doing advanced and engineering development, and test or evaluation; and a low proportion doing basic and applied research, production processes, and reliability and quality control. f. Mechanical engineering: a high proportion in production end-items; and a low proportion in both reliability and quality control, and basic research g. Chemical engineering: a high proportion in production processes, reliability and quality control, and public relations; and a low proportion in test or evaluation, and advanced development. h. Aeronautical engineering: a high proportion in advanced development, and test or evaluation; and a low proportion in production processes, production end-items, and operational development. i. Electrical engineering: a high proportion performing engineering and operational development; and a low proportion in basic research and production processes. j. Chemistry: a high proportion in both basic and applied research, and a low proportion in most others. k. Earth science: a high proportion in applied research and production processes; and a low proportion in production end-items, R&D support, and engineering and operational development. l. Physical science: a high proportion in basic and applied research; and a low proportion in test or evaluation, production processes, production end-items, and public relations. m. Mathematics: a high proportion in system analysis and R&D support; and a low proportion in engineering development, production processes, production end-items, and public relations.
Q54 vs Q58	Type of Activity vs. Equivalent GS Rating	367.78	44	$\alpha < .0005$	.438	The following features are of interest: a. Technical evaluation has the lowest ratings. b. Scientific and engineering have a complete range of ratings, but are high in the middle range. c. Technical management is heavy in the upper-middle range. d. Administrative management is heavy in the lower-middle range. e. Both technical and administrative management dominate the upper part of the range.

Table 5-7. (Cont)

<table>
<tr><th>Questions</th><th>Description</th><th>χ^2</th><th>df</th><th>α</th><th>r</th><th colspan="3">Remarks</th></tr>
<tr><td rowspan="10">Q55 vs Q56</td><td rowspan="10">Kind of Position vs. Field of Position</td><td rowspan="10">713.01</td><td rowspan="10">88</td><td rowspan="10">$\alpha < .0005$</td><td rowspan="10">.199</td><td colspan="3">The following table shows the important associations between kind and field of position.</td></tr>
<tr><td>Field of Position</td><td>High Proportion</td><td>Low Proportion</td></tr>
<tr><td>Production, management, and social sciences</td><td>Production processes, production end-items, reliability and quality control, and customer relations</td><td>Advanced development and engineering development</td></tr>
<tr><td>Medical sciences</td><td>Basic and applied research</td><td>Most of the other kinds</td></tr>
<tr><td>Mechanical, industrial, civil, and marine engineering</td><td>System analysis and customer relations</td><td>Advanced development, test or evaluation, and reliability and quality control</td></tr>
<tr><td>Aeronautics and space technology</td><td>Advanced development, and production end-items</td><td>Basic research and customer relations</td></tr>
<tr><td>Electronics and electrical engineering</td><td>Engineering development</td><td>Basic research and production processes</td></tr>
<tr><td>Chemical science and materials</td><td>Basic and applied research</td><td>System analysis, engineering and operational development, production end-items, and reliability and quality control</td></tr>
<tr><td>Physical science</td><td>Basic and applied research</td><td>Operational development, and customer relations</td></tr>
<tr><td>Research (including computer science)</td><td>System analysis, operational development, and R&D support</td><td>Production processes, production end-items, and reliability and quality control</td></tr>
</table>

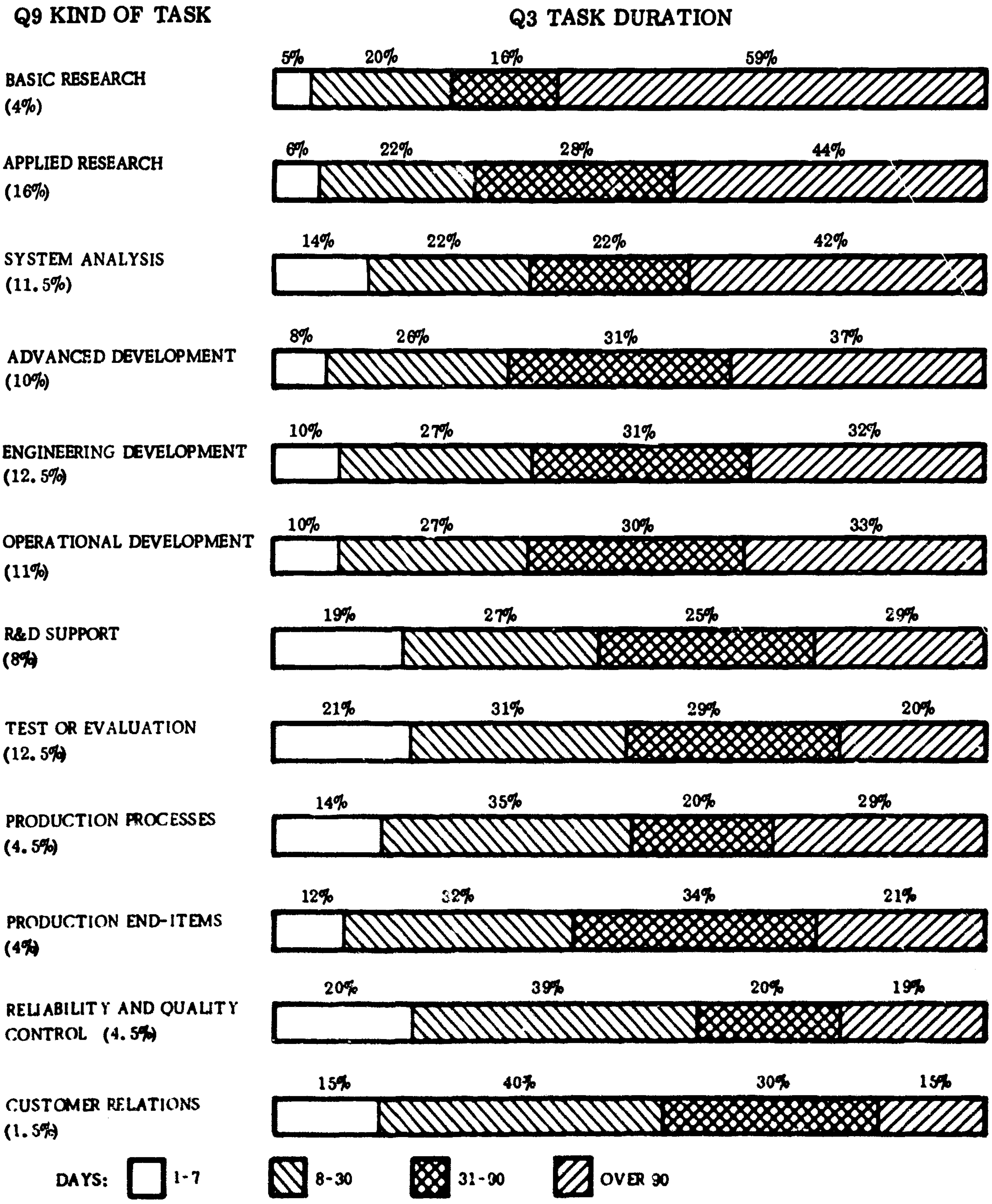
Table 5-7. (Cont)

<table>
<tr><th>Questions</th><th>Description</th><th>χ^2</th><th>df</th><th>α</th><th>r</th><th>Remarks</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td>
<table>
<tr><th>Field of Position</th><th>High Proportion</th><th>Low Proportion</th></tr>
<tr><td>Mathematics</td><td>Applied research</td><td>Engineering development and operational development, production processes, production end-items, and customer relations</td></tr>
</table>
</td></tr>
<tr><td>Q55 vs Q58</td><td>Kind of Position vs. Equivalent GS Rating</td><td>269.98</td><td>121</td><td>$\alpha < .0005$</td><td>-.214</td><td>
There is a slight tendency for respondents performing work which is closest to nature to make the most money. The following table shows the percentage of the sample within three salary ranges for each kind of position.
<table>
<tr><th>Kind of Position</th><th>GS-6 to GS-11 (%)</th><th>GS-12 to GS-14 (%)</th><th>GS-15 and above (%)</th></tr>
<tr><td>Basic research</td><td>6</td><td>50</td><td>44</td></tr>
<tr><td>Applied research</td><td>15</td><td>53</td><td>33</td></tr>
<tr><td>System analysis</td><td>15</td><td>56</td><td>29</td></tr>
<tr><td>Advanced development</td><td>8</td><td>55</td><td>38</td></tr>
<tr><td>Engineering development</td><td>17</td><td>67</td><td>17</td></tr>
<tr><td>Operational development</td><td>21</td><td>62</td><td>17</td></tr>
<tr><td>R&D support</td><td>28</td><td>53</td><td>20</td></tr>
<tr><td>Test or evaluation</td><td>38</td><td>56</td><td>7</td></tr>
<tr><td>Production processes</td><td>28</td><td>58</td><td>14</td></tr>
<tr><td>Production end-items</td><td>28</td><td>64</td><td>7</td></tr>
<tr><td>Reliability and quality control</td><td>25</td><td>55</td><td>20</td></tr>
<tr><td>Customer relations</td><td>8</td><td>66</td><td>28</td></tr>
</table>
Additional notable features:
a. Basic research: highest salaries, with 44 percent at GS-15 and above and only 6 percent below GS-12.
b. Test or evaluation: lowest salaries, with 38 percent below GS-12 and only 7 percent at GS-15 and above.
c. R&D support, and reliability and quality control: high proportion both above GS-14 and below GS-12.
</td></tr>
</table>



*See Footnote 1 on page 5-49.

Figure 5-54. Task Recipient vs Formality of Task Output*



*See Footnote 1 on page 5-49.

Figure 5-55. Kind of Task vs Task Duration*

Table 5-6. TASK Correlation Matrix

	(Q7) Task Recipient	(Q9) Kind of Task	(Q8) Class of Task	(Q10) Field of Task	(Q6) Formality of Task Output	(Q5) Type of Task Output	(Q3) Task Duration	(Q4) Percentage of Time on Task
Task Initiator (Q2)	.040	.141	.034	-.015	.065	-.070	-.038	.153
Task Recipient (Q7)		-.189	-.067	-.023	.316	-.011	.094	-.031
Kind of Task (Q9)			.181	-.133	-.081	.025	-.182	-.062
Class of Task (Q8)				-.142	-.055	.105	-.062	-.110
Field of Task (Q10)					-.091	-.123	.044	.067
Formality of Task Output (Q6)						.021	.111	.068
Type of Task Output (Q5)							-.105	-.055
Task Duration (Q3)								-.057

Table 5-9. Significant TASK Intra-Relations

Questions	Description	χ^2	df	α	r	Remarks
Q3 vs Q4	Task Duration vs. Percentage of Time on Task	68.94	32	$\alpha < .0005$	-.057	A slight tendency for respondents to spend a greater percentage of their time on short tasks.
Q3 vs Q7	Task Duration vs. Task Recipient	69.88	32	$\alpha < .0005$	.094	Several interesting features are: a. Tasks of long duration are for members of the respondent's profession. b. Tasks which are for the respondent's own use vary in duration from less than one week to more than 365 days.
Q3 vs Q8	Task Duration vs. Class of Task	154.85	96	$\alpha < .0005$	-.062	There is a slight tendency for tasks to decrease in duration as the distance from nature of the class of task increases. Two notable exceptions are: a. Tasks which involve raw data tend to be of short duration (less than 14 days). b. Tasks classified as experimental processes and procedures are of long duration.
Q3 vs Q9	Task Duration vs. Kind of Task	154.55	88	$\alpha < .0005$	-.182	The tendency is for tasks closer to nature to be of longer duration. Basic research tasks take the longest time; while test or evaluation, and reliability and quality control tend to be short.
Q6 vs Q8	Type of Task Output vs. Class of Task	676.80	72	$\alpha < .0005$	.105	Some of the more interesting associations are: a. Designs or design techniques result in decisions and hardware. b. Test processes and procedures yield hardware or a plan. c. Performance and characteristics yield findings. d. Production processes and procedures yield recommendations or decisions.
Q6 vs Q10	Type of Task Output vs. Field of Task	199.56	48	$\alpha < .0005$	-.123	The following types of output associated with a particular field are interesting features of this interaction: a. Production, management and social science yield a plan. b. Electronics and electrical engineering yield hardware. c. Physical science yields findings. d. Research (including computer science) yield technical data or information, and a plan. e. Mathematics yields findings.

Table 5-9. (Cont)

Questions	Description	χ^2	df	α	r	Remarks	
Q6 vs Q7	Formality of Task Output vs. Task Recipient	450.30	16	$\alpha < .0005$	.316	There is a strong tendency for a more formal output the further, the recipient is from the respondent.	
Q8 vs Q9	Class of Task vs. Kind of Task	1015.98	132	$\alpha < .0005$	.181	The following class-kind combinations exhibit a high frequency of occurrence:	
						Class	Kind
						Concepts	Basic and applied research
						Math aids and computer programs	Operational development and R&D support
						Designs and design techniques	Operational development and engineering
						Experimental processes and procedures	Basic and applied research
						Test processes and procedures	Test or evaluation
						Evaluation	System analysis, test or evaluation, and reliability and quality control
						Specifications	Engineering development, production end-items, and reliability and quality control
						Production processes and procedures	Production processes and production end-items
						Technical status	Applied research
						Utilization	R&D support
						Cost and funding, administrative action	R&D support

Table 5-9. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q8 vs Q10	Class of Task vs. Field of Task	719.28	96	$\alpha < .0005$	-.142	Task classes with high proportions of accompanying task fields are: a. Concepts: medical science and physical science. b. Math aids and computer programs: research (including computer science), and mathematics. c. Experimental processes and procedures: medical science and chemical science and materials. d. Evaluation: mechanical, industrial, civil, and marine engineering. e. Production processes and procedures: production, management, and social sciences, and chemical science and materials. f. Technical status: medical science, and chemical science and materials. g. Cost and funding; administrative action: production, management, and social sciences, and mechanical, industrial, civil, and marine engineering.
Q9 vs Q10	Kind of Task vs. Field of Task	541.39	88	$\alpha < .00005$	-.133	Task kinds showing high proportions of accompanying task fields are: a. Basic and applied research: medical science, chemical science and materials, and physical science. b. Operational development: research (including computer science). c. R&D support: research (including computer science). d. Production processes: production, management, and social sciences. e. Reliability and quality control: production, management and social sciences.

TASK Profile vs USER Profile

The most outstanding features of the interaction between USER and TASK is that between the kind of position and kind of task (a correlation of .67), and that between the field of position and field of task (a correlation of .71). This indicates that individuals tend to stay within the same area of task endeavor as their normal work description. The two-way frequency distributions for these interactions appear in Figures 5-56 and 5-57.

For a given kind of position, an average of 44% of the personnel cross-over to a different kind of task. The least amount of cross-over was from basic research (22%), and reliability and quality control (29%). The highest amount of cross-over was from customer relations (65%) and engineering development (56%). Almost all moves were to kind areas that were relatively close in the detailed structure, keeping a high correlation in evidence.

On the average, 27% of the personnel left their normal field of position to carry out a task in a different field. The cross-over was usually to aeronautics and space technology (25% of all cross-overs). The least amount of cross-over was in the medical sciences (13%) and chemical science and materials (17%) fields. The greatest amount of cross-over was in mathematics, where 56% of the personnel carried out a task that was assigned a different field. Here again the moves were short in relative distance, maintaining the high correlation.

The user's level grouping is the general influencer between USER and TASK, indicating that higher level personnel: work on tasks of shorter duration; deal more with recommendations, decisions and plans; have more formal task outputs; initiate their own tasks; deal directly with the customer; and work on tasks which have kind and class categories that are close to nature (research, concepts, etc.).

Table 5-10 contains the TASK vs USER correlation matrix. A summary of the significant TASK vs USER inter-relations that were found in the two-way frequency distributions is presented in Table 5-11.

UTILIZATION Profile

The UTILIZATION elements can be divided into information centers and services (including translation services), and problems encountered in the use of these centers and services. The only pattern in their use is that people who use one center or service also tend to use the others (Table 5-12).

Utilization problems are related to use of information facilities, indicating that those encountering problems tend to be the active information seekers and users. Table 5-13 presents a summary of the more informative two-way frequency distributions dealing with UTILIZATION intra-relations.

UTILIZATION Profile vs USER Profile

The USER characteristics which show the greatest interaction with UTILIZATION descriptors are kind of position, equivalent GS rating and highest degree. (See Table 5-14.) These associations indicate that the higher level personnel use information centers and services more and encounter more utilization problems. Table 5-15 presents a summary of the more significant two-way frequency distributions dealing with UTILIZATION vs USER inter-relations.

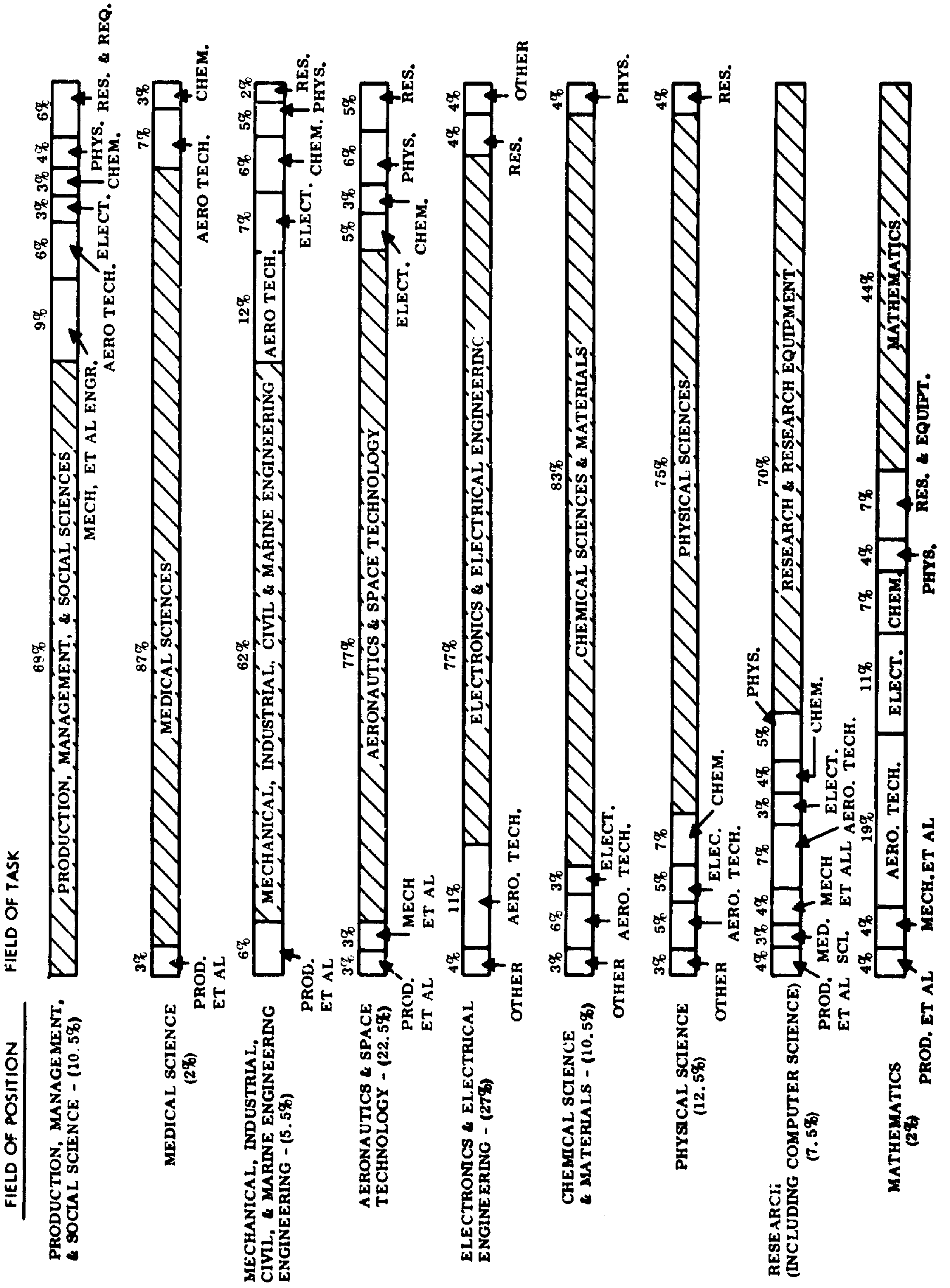


Figure 5-57. Field of Task vs Field of Position

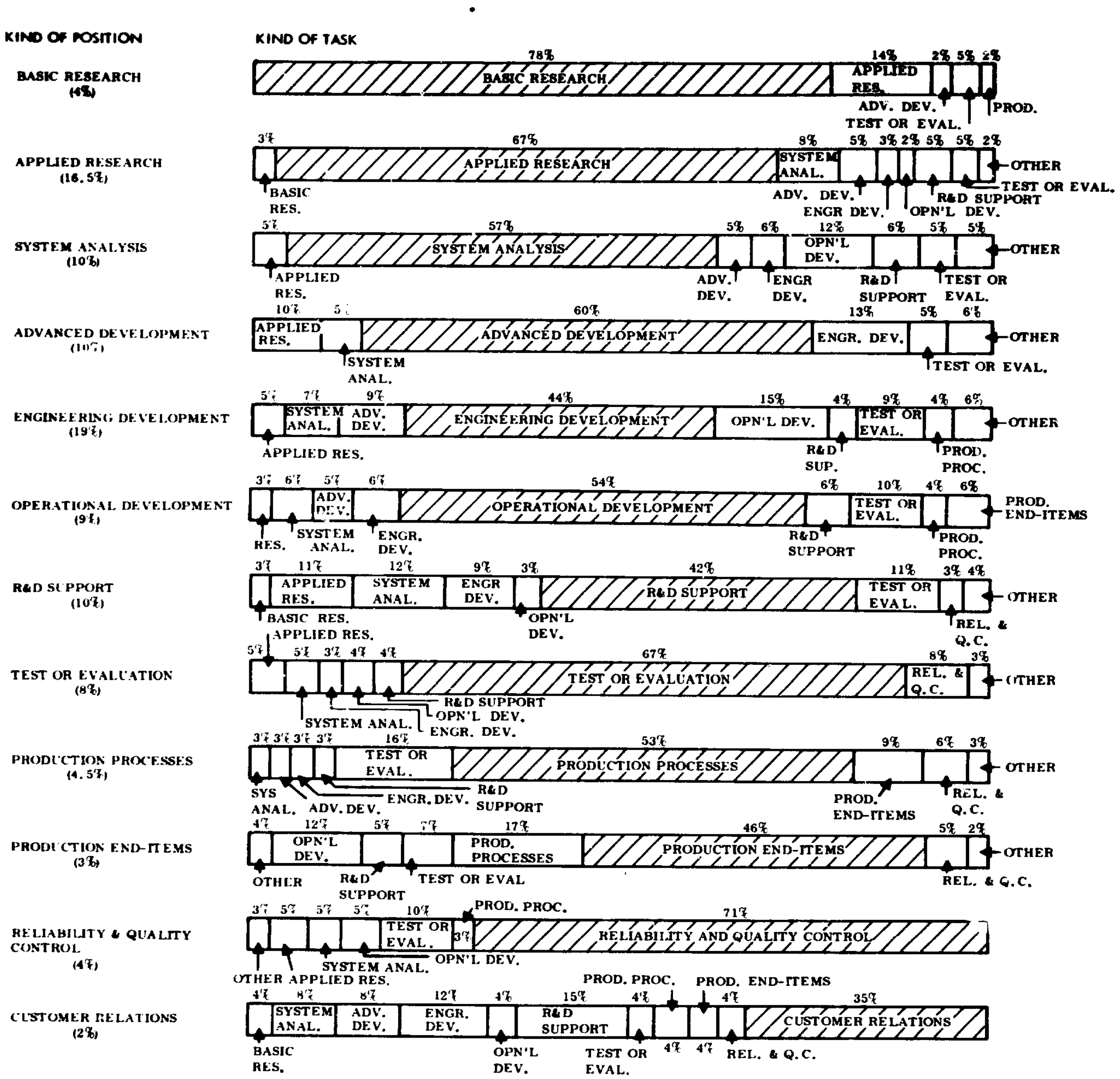


Figure 5-56. Kind of Position vs Kind of Task

Table 5-10. TASK vs. USER Correlation Matrix

		(Q48) User's Age	(Q50A) Highest Degree	(Q50C) Field of Degree	(Q50B) Year of Degree	(Q51) Job Experience	(Q52) Company Experience	(Q55) Kind of Position	(Q56) Field of Position	(Q58) Equivalent GS Rating	(Q49) Number of Personnel Supervised	(Q54) Type of Activity
Task Initiator	(Q2)	-.037	-.137	-.044	.014	-.072	-.028	.126	.006	-.094	-.014	-.015
Task Recipient	(Q7)	.067	.129	.059	-.024	.064	.041	-.114	-.039	.214	.084	.126
Kind of Task	(Q9)	-.005	-.356	-.173	-.112	-.064	.072	.660	-.135	-.257	.038	-.038
Class of Task	(Q8)	.023	-.057	-.046	-.036	-.078	.078	.207	-.160	-.017	.057	.083
Field of Task	(Q10)	-.092	.054	.240	.112	-.077	-.097	-.170	.696	-.035	-.114	-.102
Formality of Task Output	(Q6)	.029	.064	.011	-.001	.041	-.039	-.034	-.065	.108	.072	.082
Type of Task Output	(Q5)	.060	.043	-.017	-.044	.007	.058	.043	-.120	.105	.099	.087
Task Duration	(Q3)	.070	.174	.166	-.022	.089	.057	-.173	.057	.146	.031	.049
Percentage of Time on Task	(Q4)	-.086	-.057	.024	.079	-.072	-.163	-.086	.105	-.184	-.276	-.298

Table 5-11. Significant TASK vs USER Inter-Relations

Questions	Description	χ^2	df	α	r	Remarks
Q9 vs Q58	User's Kind of Task vs. Equivalent GS Rating	274.28	121	$\alpha < .0005$	-.257	Higher ratings are related to those tasks closer to nature (research). R&D support is somewhat normally distributed, with a slight loading to the low end of the scale.
Q10 vs Q55	Field of Task vs.	575.01	88	$\alpha < .0005$	-.170	The Field groupings show high proportions as follows: a. Production, management, and social sciences: production processes, production end-items, and reliability and quality control. b. Medical sciences: research (There are entries in only research, R&D support, operational development, and system analysis). c. Mechanical, industrial, civil, and marine engineering: system analysis and customer relations. d. Aeronautics and Space Technology: very little basic research. e. Electronics and electrical engineering: no basic research, but a high proportion in engineering development. f. Chemical science and materials: basic and applied research. g. Physical science: basic and applied research. h. Research (including computer science): System analysis and operational development. i. Mathematics: basic and applied research.
Q10 vs Q56	Field of Task vs. Field of Position	5710.39	64	$\alpha < .0005$	.696	The following are the incidences of high proportional cross-over (position to task): a. Behavioral and social sciences: to mechanical, industrial, civil, and marine engineering (28%); aeronautics and space technology, and research (including computer science) (19% each). b. Medical sciences: to aeronautics and space technology (54%). c. Mechanical, industrial, civil, and marine engineering: to aeronautics and space technology (32%); electronics and electrical engineering (18%); production, management, and social sciences, and chemical sciences and materials (16% each). d. Aeronautics and space technology: to physical science (25%); electronics and electrical engineering, and research (including computer science) (20% each). e. Electronics and electrical engineering: to aeronautics and space technology (48%) f. Chemical sciences and materials: to aeronautics and space technology (35%), and physical science (23%) g. Physical science: to chemical sciences and materials (28%); aeronautics and space technology, and electronics and electrical engineering (20% each).

Table 5-11. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q10 vs Q56 (Cont)						h. Research (including computer science): to aeronautics and space technology (23%); physical science (17%); production, management and social sciences, and mechanical, industrial, civil, and marine engineering (13% each). i. Mathematics: to aeronautics and space technology (34%); electronics and electrical engineering (20%); chemical sciences and materials, and research (including computer science) (12% each). Cross-over was usually to aeronautics and space technology (25% of all cross-overs). The least amount of cross-over was from medical sciences (13%), and chemical sciences and materials (17%). The greatest amount of cross-over took place in mathematics (56%). On the average, 27% of the personnel left their normal field of position for a different field of task.
Q7 vs Q55	Task Recipient vs. Kind of Position	293.92	44	α<.0005	-.114	The further the task is from nature, the closer the task recipient is to the respondent.
Q7 vs Q58	Task Recipient vs. Equivalent GS Rating	184.55	44	α<.0005	.214	The higher the respondent's GS rating, the greater the tendency for the output of his task to go to an outside organization.
Q9 vs Q55	Kind of Task vs. Kind of Position	4738.71	121	α<.0005	.660	The following are the incidence of high proportion cross-overs (position to task): a. Applied research: to system analysis (24%); advanced development, R&D support, and test or evaluation (15% each). b. System analysis: to operational development (28%). c. Advanced development: to engineering development (32%), and applied research (25%). d. Engineering development: to operational development (23%); advanced development, and test or evaluation (20% each). e. Operational development: to test or evaluation (22%); system analysis, engineering development, R&D support, and production end-items (13% each). f. R&D support: to system analysis, applied research, and test or evaluation (20% each). g. Test or evaluation: to reliability and quality control (24%); applied research and system analysis (15% each). h. Production processes: to test or evaluation (34%), and production end-items (19%). i. Production end-items: to production processes (31%), and operational development (22%). j. Reliability and quality control: to test or evaluation (34%); applied research, system analysis, and operational development (17% each). k. Customer relations: to R&D support (23%), and engineering development (18%).

Table 5-11. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q9 vs Q55 (Cont)						The least amount of cross-over was for basic research (20%), and reliability and quality control (29%). The greatest amount of cross-over was for engineering development (66%) and customer relations (65%). On the average, 44% of the personnel crossed from a position kind to a different task kind. When kind categories are pooled as in Phase I, the cross-over rate drops to about 25%.
Q9 vs Q56	Kind of Task vs. Field of Position	580.36	88	$\alpha < .0005$	-.135	No distinct patterns are evident. Some interesting features are: a. Production, management, and social sciences: a high proportion in production processes, reliability and quality control, and customer relations. b. Medical sciences: a high proportion in basic and applied research. c. Mechanical, industrial, civil, and marine engineering: a high proportion in system analysis. d. Aeronautics and space technology: a low proportion in basic research, production processes, and customer relations. e. Electronics and electrical engineering: a high proportion in operational development; and a low proportion in basic research. f. Chemical science and materials: a high proportion in basic and applied research; and a low proportion in systems analysis and operational development. g. Physical science: a high proportion in basic and applied research; and a low proportion in operational development. h. Research (including computer science): high in operational; development.

Table 5-12. UTILIZATION Correlation Matrix

	(Q40) Use of DOD Specialized Information Centers	(Q41) Use of Other Specialized Information Centers	(Q38) Use of STAR	(Q44) Use of English Abstracts or Translations	(Q37) Use of TAB	(Q39) Use of DDC	(Q42) Encounter of Restrictions	(Q45) Encounter of Difficulties
Use of Company TIC (Q35)	.203	.197	.209	.334	.271	.293	.113	.102
Use of DOD Specialized Information Centers (Q40)		.171	.183	.201	.214	.305	.134	.133
Use of Other Specialized Information Centers (Q41)			.087	.229	.089	.149	.083	.110
Use of STAR (Q38)				.212	.504	.243	.081	.063
Use of English Abstracts or Translations (Q44)					.283	.271	.116	.086
Use of TAB (Q37)						.414	.166	.065
Use of DDC (Q39)							.217	.112
Encounter of Restrictions (Q42)								.128

Table 5-13. Significant UTILIZATION Intra-Relations

Questions	Description	χ^2	df	α	r	Remarks
Q35 vs Q36	Use of Company TIC vs. Evaluation of Company TIC	877.01	12	$\alpha < .0005$	.247*	There is a tendency for those who use TIC twice or more a month to almost always find the needed information. A high proportion of those using TIC once a month seldom get what is needed.
Q37 vs Q38	Use of TAB vs. Use of STAR	839.53	16	$\alpha < .0005$	.504	Those who know of and use TAB know of and use STAR: 56% of those who know of TAB also know of STAR, and 41% of those who use TAB also use STAR.
Q37 vs Q39	Use of TAB vs. Use of DDC	497.09	8	$\alpha < .0005$	.414	Respondents who know of and use TAB tend also to know of and use DDC: 87% of those who know of TAB also know of DDC, while 75% of those who use TAB also use DDC.
Q37 vs Q40	Use of TAB vs. Use of DOD Specialized Information Centers	118.59	8	$\alpha < .0005$	.214	The tendency is for respondents who know of and use TAB to also know of and use DOD Specialized Information Centers: 73% of those who know of TAB also know of these centers, and 59% of those who use TAB also use these centers.
Q37 vs Q43	Use of TAB vs. Nature of Restrictions	60.58	8	$\alpha < .0005$	.253*	Although there is no distinct pattern, there are some interesting features: a. Respondents who do not know of TAB encounter a high proportion of proprietary restrictions. b. Those who use TAB at least once every 2 or 3 months tend to encounter both proprietary and security restrictions.
Q38 vs Q39	Use of STAR vs. Use of DDC	157.30	8	$\alpha < .0005$	.243	There is a moderate tendency for those who know of and use DDC to also know of and use STAR.
Q39 vs Q40	Use of DDC vs. Use of DOD Specialized Information Centers	163.63	4	$\alpha < .0005$	.305	Features of interest: a. Some 49% of the respondents who know of DDC also know of DOD Specialized Information Centers while 60% of those who know of these centers also know of DDC. b. Some 22% of those using DDC also use these centers; and of those who use these centers, 20% also use DDC.
Q39 vs Q43	Use of DDC vs. Nature of Restrictions	57.65	4	$\alpha < .0005$	.270*	Of the people who encounter restrictions, those who don't know of DDC encounter a high proportion of proprietary restrictions; while those using DDC tend to have both proprietary and security restrictions.
Q40 vs Q41	Use of Specialized Information Centers vs. Use of Other Specialized Information Centers	39.12	2	$\alpha < .0005$	.171	Slight tendency for those who know of and use DOD Specialized Information Centers to also use other specialized information centers.

*Taken from two-way table rather than from matrix.

Table 5-14. UTILIZATION vs. USER Correlation Matrix

		(Q48) User's Age	(Q50A) Highest Degree	(Q50C) Field of Degree	(Q50B) Year of Degree	(Q51) Job Experience	(Q52) Company Experience	(Q55) Kind of Position	(Q56) Field of Position	(Q58) Equivalent GS Level	(Q49) Number of Personnel Supervised	(Q54) Type of Activity
Use of Company TIC	(Q35)	.070	.226	.133	.021	.033	-.025	-.273	.065	.170	.007	.083
Use of DOD Specialized Information Centers	(Q40)	.092	.107	.055	-.053	.099	.033	-.071	.017	.197	.124	.130
Use of Other Specialized Information Centers	(Q41)	.086	.160	.039	-.024	.061	.015	-.104	-.044	.164	.071	.088
Use of STAR	(Q38)	-.002	.112	.036	.052	-.017	-.037	-.114	.050	.093	.028	.065
Use of English Abstracts or Translation	(Q44)	.065	.332	.189	.039	.107	-.021	-.300	..07	.244	.040	.055
Use of TAB	(Q37)	.032	.211	.117	.062	-.006	-.057	-.216	.064	.198	.012	.104
Use of DDC	(Q39)	.070	.255	.123	.040	.036	-.019	-.303	.085	.304	.071	.121
Encounter of Restrictions	(Q42)	-.010	.103	.065	.046	-.021	-.004	-.100	-.045	.156	.058	.095
Encounter of Difficulties	(Q45)	-.043	.118	.038	.051	-.001	-.041	-.083	-.010	.101	.011	.043

Table 5-15. Significant UTILIZATION vs. USER Inter-Relations

Questions	Description	χ^2	df	α	r	Remarks
Q35 vs Q50A	Use of Company TIC vs. Highest Degree	128.67	15	$\alpha < .0005$	.226	The higher the respondent's degree, the more frequently he uses TIC. A high proportion of those with no degree never use TIC, while those with doctor's degrees use it twice or more a month.
Q35 vs Q55	Use of Company TIC vs. Kind of Position	224.37	33	$\alpha < .0005$	-.273	There is a moderate tendency for those performing activities close to nature to use TIC more frequently. Interesting features of this interaction are: a. Basic and applied research personnel use TIC twice or more a month. b. Persons in test or evaluation tend to use it once a month. c. A high proportion of those in customer relations and production end-items never use TIC.
Q37 vs Q50A	Use of TAB vs. Highest Degree	134.73	20	$\alpha < .0005$	.211	There is a tendency for persons with advanced degrees to know of and use TAB more than persons with no degree. Both master's and doctor's degrees have a high proportion of persons who use TAB every issue or almost every issue.
Q37 vs Q55	Use of TAB vs. Kind of Position	184.39	44	$\alpha < .0005$	-.216	The closer the activity to nature, the greater the knowledge of and use of TAB. A high proportion of respondents engaged in test or evaluation and production processes and procedures do not know of TAB. Of the respondents who know of TAB: a. Applied research: a high proportion use it every issue or almost every issue. b. Advanced development: a high proportion use or see it about once every 6 months. c. Basic research: a high proportion use it every issue or almost every issue, and another group do not ever use it.
Q37 vs Q58	Use of TAB vs. Equivalent GS Rating	159.49	44	$\alpha < .0005$	.198	There is a tendency toward a greater knowledge and use of TAB at the higher salary levels: a. Some 73% of the sample above GS-14 know of TAB; and of these, 64% use it. b. Only 48% of those at GS-14 or below know of TAB, and 39% of these respondents actually use it.
Q38 vs Q50A	Use of STAR vs. Highest Degree	48.60	20	$\alpha < .0005$	.112	There is a slight tendency for persons with higher degrees to know of and use STAR.

Table 5-15. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q38 vs Q55	Use of STAR vs. Kind of Position	136.78	44	$\alpha < .0005$	-.114	They are not independent. Some features of interest: a. Basic research: a high proportion use STAR every issue or almost every issue. b. Advanced development: tendency to use it every 2 or 3 months and every 6 months. c. Production end-items: a high proportion never use STAR. d. Production process: high in personnel who don't know of STAR.
Q39 vs Q50A	Use of DDC vs. Highest Degree	145.21	10	$\alpha < .0005$	.255	Tendency toward those with higher degrees knowing of and using DDC.
Q39 vs Q54	Use of DDC vs. Type of Activity	42.19	8	$\alpha < .0005$	.121	Features of interest: a. Those with a high proportion of "don't know of DDC" responses are technical evaluation and administrative management personnel.
Q39 vs Q55	Use of DDC vs. Kind of Position	193.93	22	$\alpha < .0005$	-.303	They are not independent. There is a tendency for greater knowledge and use of DDC, the closer the position is to nature. a. Applied research: a high proportion know of and use DDC. b. Production processes, production end-items, and reliability and quality control: a high proportion do not know of DDC.
Q39 vs Q58	Use of DDC vs. Equivalent GS Rating	202.70	22	$\alpha < .0005$	.304	As GS ratings increase, knowledge of and use of DDC increases.
Q40 vs Q54	Use of DOD Specialized Information Centers vs. Type of Activity	38.11	8	$\alpha < .0005$	.130	Interesting features: a. Low use by medical sciences and research (including computer science) personnel. b. Medical sciences and mathematics personnel show high proportion of those who "know of the centers, but do not use them".
Q40 vs Q58	Use of DOD Specialized Information Centers vs. Equivalent GS Rating	101.81	22	$\alpha < .0005$	.197	As GS ratings go up, knowledge and use of specialized information centers rises.

Table 5-15. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q43 vs Q53	Nature of Restriction vs. Kind of Position	64.54	22	$\alpha < .0005$	-.134*	Some interesting features: a. Basic research: a high incidence of security restrictions. b. Some 72% of all restrictions encountered were associated with applied research, system analysis, and development.
Q45 vs Q50A	Encounter of Difficulties vs. Highest Degree	25.61	5	$\alpha < .0005$	.118	No significant pattern is evident, but there is a slight tendency for those with higher degrees to report more problems.
Q45 vs Q58	Encounter of Difficulties vs. Equivalent GS Rating	38.82	11	$\alpha < .0005$	.101	There is a tendency for personnel with higher ratings to encounter more problems. *Taken from two way table rather than matrix.

UTILIZATION Profile vs TASK Profile

The only TASK element that consistently relates to UTILIZATION is kind of task, with those tasks oriented towards research (close to nature) using information centers and services more often (see Table 5-16). This interaction is probably a reflection of that between kind of position and utilization of information centers and services. Utilization problems do not show any strong interaction with TASK questions.

SEARCH AND ACQUISITION Profile

The interactions among SEARCH AND ACQUISITION questions are varied (Table 5-17). A unique feature is that neither class nor field of information relate significantly with any of the other SEARCH AND ACQUISITION questions, although there is the usual interaction between class and field. It is similarly true for how essential the information was to the task and how extensively it was used in the performance of the task: these two questions relate only to each other and to the depth or detail of the information media.

There are five pairs of questions which investigated the desired, as well as the actually received, SEARCH AND ACQUISITION questions. There are very high correlations between the desired and actual questions; volume of information media, (.83), layout of information media (.86), and composition of information media (.80). Although acquisition time and depth of information media both have correlations of .68, the corresponding two-way frequency distributions between desired and actual indicate some differences between them. The time that could be allowed to get information was usually equal to or greater than that actually required to obtain it, except for 5% of the information chunks (Figure 5-58). Also more specific answers and detailed analyses were desired than received. However, people generally received the information desired, in the media desired and time desired (see Figure 5-59).

The first source approached for information exhibits interactions with the desired and actual acquisition times, and the volume and layout of the information media. Thus, as the individual moved farther from himself or his local work environment: the more time it took to get information: the more time he had allotted for search and acquisition; the greater was the volume of documentation (desired and received); and the more formal was the layout of the information media. The reason for using this first source is related only to the first source itself, indicating that the use of external information sources is predicated on a hope of receiving the information from the outside source. The amount of information received from the first source is related negatively to acquisition time, and volume and layout of the information media. If all or most of the information was acquired from the first source, then there was generally little time available or needed for its acquisition, a single document acquired, and a more or less informal information medium employed.

Volume of the information media is related to acquisition time, and composition and layout of the information media. These are positive relationships, with a requirement for a greater volume of material available being associated with the less demanding time aspects or formal media aspects. The actual depth of the information media has an interaction with the composition of the information media: the more depth received, the more formal the composition is likely to be. On the other hand, desired depth is related to both composition and layout of the information. The use of title listings and abstracts shows an association with depth, volume, composition and layout of information media, first source for information and acquisition time.

Table 5-16. UTILIZATION vs. TASK Correlation Matrix

		(Q2) Task Initiator	(Q7) Task Recipient	(Q9) Kind of Task	(Q8) Class of Task	(Q10) Field of Task	(Q6) Formality of Task Output	(Q5) Type of Task Output	(Q3) Task Duration	(Q4) Percentage of Time on Task
Use of Company TIC	(Q35)	-.101	.093	-.280	-.019	.009	.103	.093	.072	.006
Use of DOD Specialized Information Centers	(Q40)	-.026	.033	-.077	-.031	-.010	.047	.086	.027	-.070
Use of Other Specialized Information Centers	(Q41)	-.037	.033	-.116	.036	-.078	.001	.129	.066	-.098
Use of STAR	(Q38)	-.015	-.001	-.105	-.008	-.001	.026	.064	.024	.025
Use of English Abstracts or Translations	(Q44)	-.151	.095	-.290	-.038	.072	.031	.034	.124	-.063
Use of TAB	(Q37)	-.057	.071	-.191	-.051	.026	.047	.032	.078	.021
Use of DDC	(Q39)	-.043	.105	-.287	-.027	-.027	.064	.052	.075	.002
Encounter of Restrictions	(Q42)	.016	.030	-.122	-.013	-.011	.031	.048	.062	.016
Encounter of Difficulties	(Q45)	-.082	.013	-.082	-.058	-.010	-.018	.061	.025	-.043

Table 5-17. SEARCH and ACQUISITION Correlation Matrix

		Class of Information (Q28)	Field of Information (Q29)	Desired Depth of Information Media (Q25)	Desired Volume of Information Media (Q22)	Actual Depth of Information Media (Q24)	Actual Volume of Information Media (Q21)	Desired Composition of Information Media (Q20)	Desired Layout of Information Media (Q27)	Actual Composition of Information Media (Q18)	Actual Layout of Information Media (Q26)	Usual Composition of Information Media (Q19)	Why Used First Source for Information (Q15)	Location of First Source for Information (Q14)•	Acquisition from First Source for Information (Q17)	Desired Acquisition Time (Q13)	Actual Acquisition Time (Q12)	Essentiality of Information (Q30)	Usefulness of Title Listings or Abstracts (Q23)	Discovery of Post Task Information (Q32)
Class of Information	(Q28)		-.21	-.04	.00	-.04	.01	.00	.08	-.02	.08	.01	.01	.08	-.01	.02	.05	.01	-.04	-.02
Field of Information	(Q29)			.02	-.03	.01	-.03	.01	.01	.02	.01	.02	.02	-.03	.01	.01	-.02	.01	.05	.02
Desired Depth of Information Media	(Q25)				.08	.69	.08	.12	.11	.15	.12	-.03	.05	.05	-.05	.06	.10	.06	.15	.02
Desired Volume of Information Media	(Q22)					.03	.83	.16	.25	.15	.24	.09	-.03	.20	-.28	.23	.25	.03	.25	.10
Actual Depth of Information Media	(Q24)						.05	.06	.06	.13	.06	-.01	.05	-.02	.09	.01	.01	.12	.09	.00
Actual Volume of Information Media	(Q21)							.15	.24	.14	.23	.07	-.03	.19	-.25	.19	.22	.06	.21	.06
Desired Composition of Information Media	(Q20)								.26	.80	.24	-.01	-.05	.19	-.12	.06	.09	-.06	.27	.06
Desired Layout of Information Media	(Q27)									.26	.56	.00	-.04	.19	-.19	.18	.21	-.02	.21	.05
Actual Composition of Information Media	(Q18)										.25	-.02	-.06	.17	-.08	.05	.05	-.03	.30	.03
Actual Layout of Information Media	(Q26)											.01	-.04	.17	-.19	.16	.20	-.02	.20	.05
Usual Composition of Information Media	(Q19)												-.04	-.03	-.06	.02	.01	.00	.09	.00
Why Used First Source for Information	(Q15)													.12	.05	-.04	-.02	-.01	.03	-.05
Location of First Source for Information	(Q14)														-.08	.18	.24	-.05	.14	.07
Acquisition From First Source for Information	(Q17)															-.19	-.23	.08	-.26	-.10
Desired Acquisition Time	(Q13)																.68	-.03	.15	.09
Actual Acquisition Time	(Q12)																	.02	.16	.09
Essentiality of Information	(Q30)																		-.04	-.05
Usefulness of Title Listings or Abstracts	(Q23)																			.07
Discovery of Post Task Information	(Q32)																			

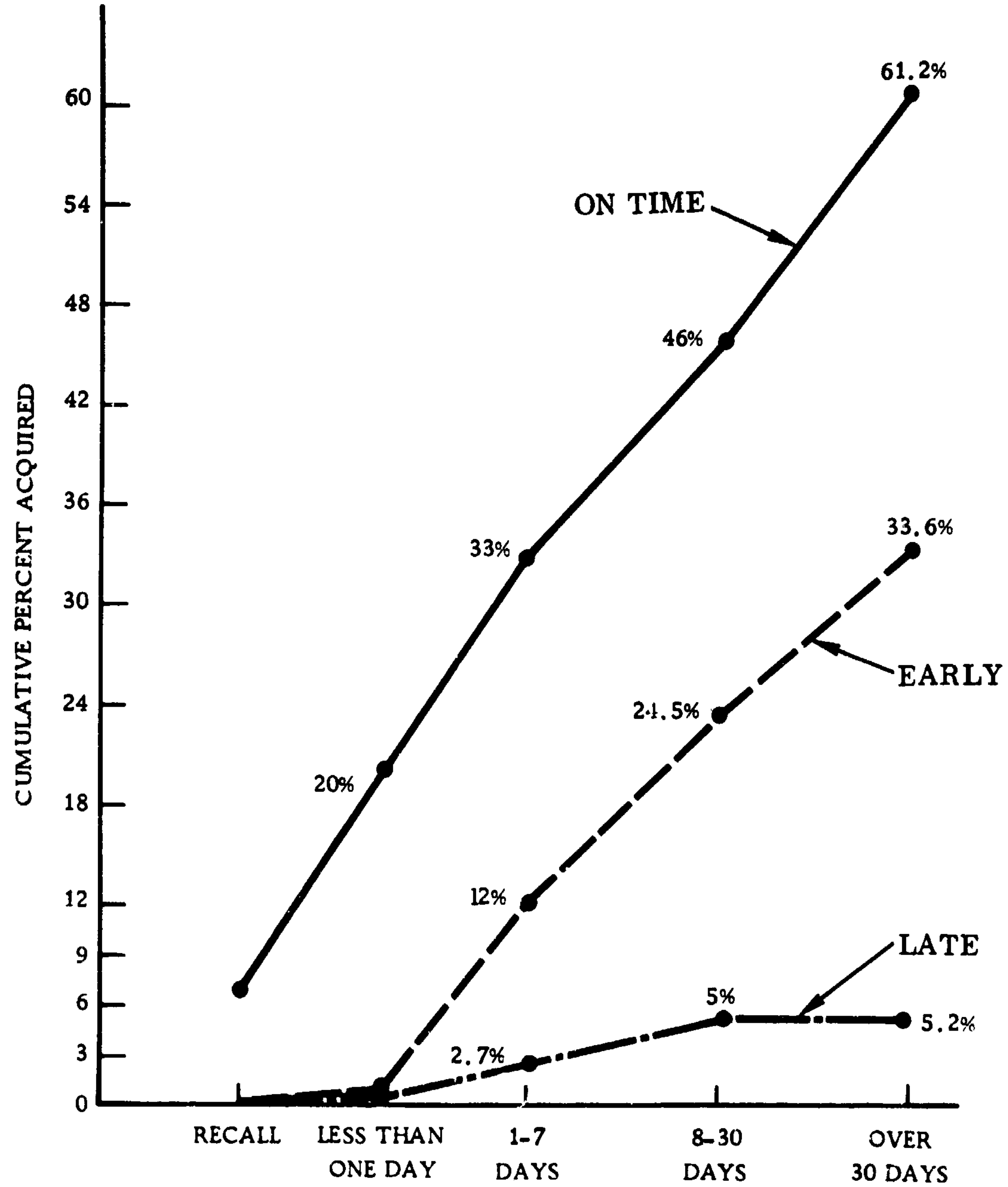


Figure 5-58. Timely Acquisition of Information

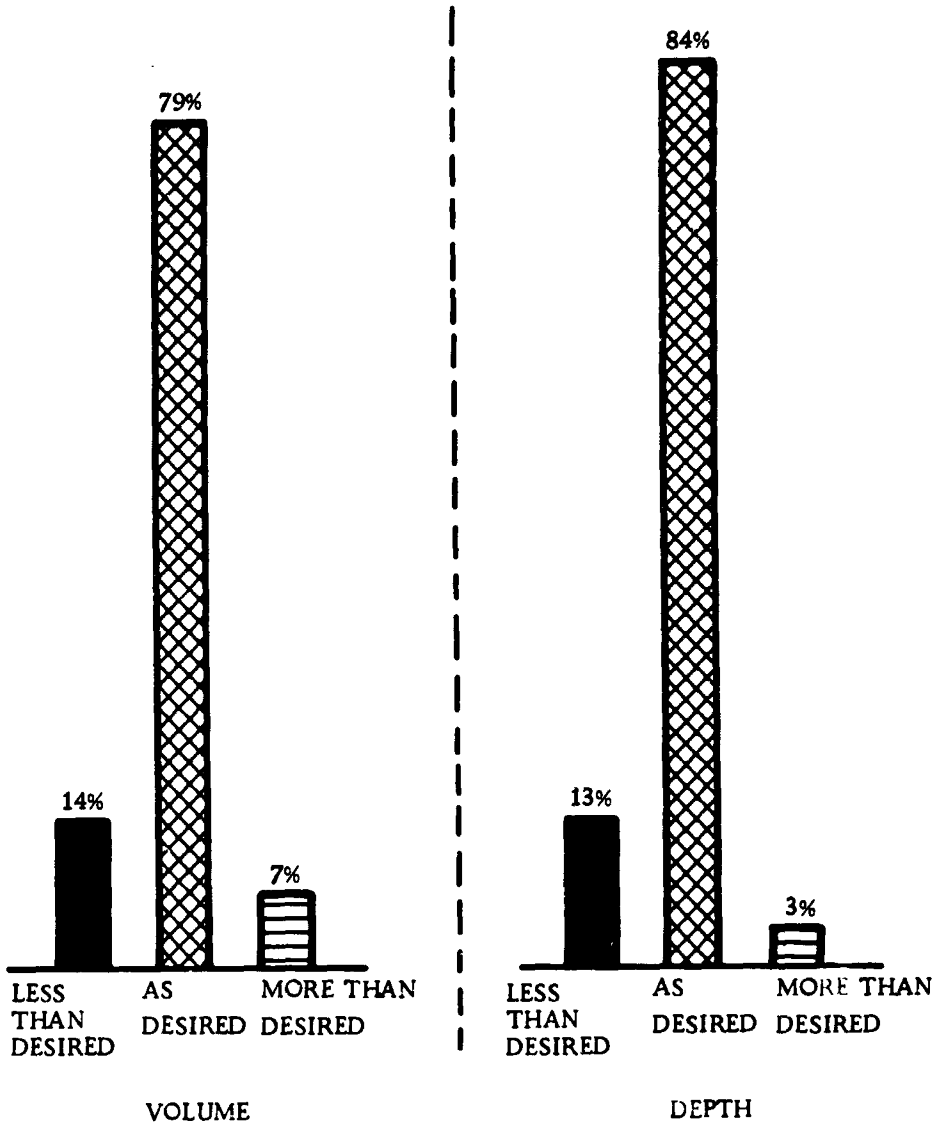


Figure 5-59. Volume and Depth of Information Media

The strongest interaction is with composition, where the desire for more formal documentation and presentation is associated with the use or potential use of title listings or abstracts.

A summary of the significant intra-relations of the SEARCH AND ACQUISITION questions, as evidenced by the two-way frequency distributions, is presented in Table 5-18.

SEARCH AND ACQUISITION Profile vs USER Profile

There are few interactions established between USER and SEARCH AND ACQUISITION questions. (See Table 5-19.) The three user characteristics that do appear to have some association are kind of position, equivalent GS rating and highest degree. They correlate with desired and actual acquisition time, and use of title listings or abstracts. This is an indication that higher level personnel tend to longer acquisition times and the use of search aids more often.

Table 5-18. Significant SEARCH and ACQUISITION Intra-Relations

Questions	Description	χ^2	df	α	r	Remarks
Q14 vs Q17	Location of First Source for Information vs. Acquisition from First Source for Information	355.63	56	$\alpha < .0005$	-.076	Some 47% of cases received all the information required from the first source. No significant differences within first source for "all the information needed" or "part of the information". Best first sources: assigned a subordinate to get it (67% for "all the information needed") and received with task (62% for "all the information needed"). Worst first sources: supervisor (29% for "all the information needed") and libraries (34% for "all the information needed"). High proportion features: a. Irrelevent or inappropriate information: library, DOD information systems, and customer. b. Nothing: supervisor, library, external consultant, and customer. c. Reference to another source: colleague, supervisor, and library.
Q14 vs Q22	Location of First Source for Information vs. Desired Volume of Information Media	1825.99	42	$\alpha < .0005$	.201	Features of interest: a. Some 34% of those who used recall as first source received all their information from recall. b. Only 7% of those who received all of their information from recall used another source as the first source - all being from the local work environment. c. One report or document has a relatively high proportion that was received with the task or went to the supervisor or customer. d. Sampling has a low proportion that was received with the task or went to the customer or external consultant. e. All material available has a high proportion that went to company libraries.
Q14 vs Q28	Location of First Source for Information vs. Class of Information	1028.65	168	$\alpha < .0005$	.084	High proportion features: a. Received with task: specifications. b. Recall: concepts, math aids and computer programs, and test processes and procedures. c. Searched own collection: math aids and computer programs. d. Respondent's own action: experimental processes and procedures, and raw data. e. Assigned subordinate to get it: technical status, cost and funding, experimental processes and procedures, and evaluation. f. Asked a colleague: math aids and computer programs. g. Asked supervisor: production process and procedures, and specifications.

Table 5-18. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q12 vs Q21	Actual Acquisition Time vs. Actual Volume of Information Media	2490.41	18	$\alpha < .0005$	.215	There is a tendency for more volume of information to be related to longer acquisition time. Items of interest: a. Acquisition in less than one day has a high proportion of one report items. b. Some 29% of those who received data in less than 1 day, reported that they received all available and pertinent information. c. A sampling of available information is related to longer acquisition time. d. All information available shows no effect of acquisition time, except for being low in recall.
Q13 vs Q14	Desired Acquisition Time vs. Location of First Source for Information	1900.87	70	$\alpha < .0005$	.177	As the time allowed to acquire information goes up, the first source has a tendency to be further from the respondent. Features of interest: a. Received with task assignment associated with less than 1 day. b. Respondent's own action associated with longer acquisition time (over 90 days). c. Internal company consultant associated with longer acquisition times (31-90 days). d. Company library associated with tasks lasting over 1 week. e. External consultant, DOD information systems and customer associated with longer acquisition times.
Q13 vs Q22	Desired Acquisition Time vs. Desired Volume of Information Media	1734.01	15	$\alpha < .0005$	.227	The length of time allowable is greater when a greater volume of information is desired.
Q14 vs Q15	Location of First Source for Information vs. Why Used First Source for Information	6434.87	70	$\alpha < .0005$	.119	Features of interest: a. Available or easy to use: a high proportion from recall and own collection. b. Found helpful previously: a high proportion from subordinate, company library and supervisor. c. Most authoritative: a high proportion from colleague, internal consultant, manufacturer or supplier, external consultant, DOD information center, system and customer. d. Only source known: a high proportion from respondent's own action, manufacturer or supplier, and customer. e. Told or knew was available from source: a high proportion from recall and department files.

Table 5-18. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q12 vs Q13	Actual Acquisition Time vs. Desired Acquisition Time	7786.22	36	$\alpha < .0005$	.684	In general, only 5% of the information was not received within the desired time limit. Also 33% of the information was received before the time requirement.
Q21 vs Q22	Actual Volume of Information Media vs. Desired Volume of Information Media	10392.48	9	$\alpha < .0005$	.826	Interesting features: a. Some 96% of those who desired information by recall or sampling, received it in that manner. b. Some 79% of those desiring information in one report or document, received it in that manner - with 17% of the data from a sampling. c. Some 68% of those desiring all the material available, acquired this depth of information with 29% receiving only a sampling.
Q24 vs Q25	Actual Depth of Information Media vs. Desired Depth of Information Media	5362.95	4	$\alpha < .0005$	.692	The user usually gets the depth he desires (79% - 95%). If he gets a specific answer or detailed analysis, he usually wants this depth of information (96% and 92% respectively). However, "once-over-lightly" information was desired in this form only 39% of the time.
Q26 vs Q27	Actual Layout of Information Media vs. Desired Layout of Information Media	50873.39	256	$\alpha < .0005$	.863	Features of interest: a. The layouts containing oral communications (telephone, informal briefings, group discussion and combinations including oral information) have an actual to desired proportion of only about 60%, and a desired to actually received proportion of about 90%. b. The more formal layouts (graphics, text, lists and combinations) have an actual to desired proportion of about 90%, and a desired to actual proportion of about 80%. c. Recall was actually received 97% of time desired, and desired 92% of the time actually received. d. The low occurrence layouts (photos, slides, micro-form and formal briefings) are usually desired when actually received, but have low actually received when desired proportions.
Q12 vs Q14	Actual Acquisition Time vs. Location of First Source for Information	2823.63	84	$\alpha < .0005$	.240	The greater the acquisition time, the more distant the first source.

Table 5-18. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
						h. Library: Experimental processes and procedures. i. External consultant: technical status, raw data, and utilization. j. DOD information systems: technical status, and cost and funding. k. Asked customer: cost and funding.
Q17 vs Q22	Acquisition from First Source for Information vs. Desired Volume of Information Media	713.30	12	$\alpha < .0005$	-.279	There is a tendency for the greater the desired volume, the less the amount received from the first source. Recall and one report or document has a high proportion of "received all the information needed". A sampling has a high proportion of "part of the information" and a "reference to another source". A unique characteristic is that 57% of those who reported they received irrelevant or inappropriate information from the first source, ended up with all the information that could be found pertinent to the subject.
Q21 vs Q26	Actual Volume of Information Media vs. Actual Layout of Information Media	2627.57	48	$\alpha < .0005$	.232	The greater the depth, the more formal the layout. Features of interest: a. One report or document: a high proportion of telephone, table or list, and narrative text. b. Sampling: a high proportion of graphic; text and oral; and graphics text, oral and recall. c. All material available: no outstanding features
Q21 vs Q27	Actual Volume of Information Media vs. Desired Layout of Information Media	2639.51	66	$\alpha < .0005$	.243	Same basic pattern and characteristics as Q21 vs. Q26.
Q22 vs Q23	Desired Volume of Information Media vs. Usefulness of Title Listings or Abstracts	563.51	6	$\alpha < .0005$	.249	As more volume is desired, there is a tendency to use title listings or abstracts more.
Q22 vs Q27	Desired Volume of Information Media vs. Desired Layout of Information Media	2710.91	48	$\alpha < .0005$	.254	Same pattern as Q21 vs. Q26 and Q21 vs. Q27.

Table 5-18. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q22 vs Q32	Desired Volume of Information Media vs. Discovery of Post Task Information	63.76	3	$\alpha < .0005$	.104	There is a slight tendency for those desiring more volume to discover post task information, but there are no outstanding features.
Q24 vs Q31	Actual Depth of Information Media vs. Extensiveness of Information Use	308.51	10	$\alpha < .0005$	.121	The greater the depth desired, the more the likelihood that the data will be used throughout the task or in a major portion of the task.
Q24 vs Q29	Class of Information vs. Field of Information	2884.62	96	$\alpha < .0005$	-.206	As class of information moves from research to customer relations, there is a tendency for field of information to move from mathematics to production. Features of interest: a. Production, management and social sciences: a high proportion of production processes and procedures, utilization, and cost and administrative action; and a low proportion of math aids and computer programs, and experimental processes and procedures. b. Medical sciences: a high proportion of raw data, experimental processes and procedures, and technical status. c. Aeronautics and space technology: a high proportion of design or design techniques; and a low proportion of math aids and computer programs, experimental processes and procedures, and production processes and procedures. d. Electronics and electrical engineering: a low proportion of math aids and computer programs. e. Chemical sciences and materials: a high proportion of raw data, experimental processes and procedures, and production processes and procedures. f. Physical science: a high proportion of concepts; and a low proportion of production processes and procedures, cost and administrative action, and utilization. g. Research (including computer science): a high proportion of math aids and computer programs, and experimental processes and procedures; and a low proportion of concepts, raw data and evaluation.

Table 5-18. (Cont)

Questions	Description	X^2	df	α	r	Remarks
						h. **Mathematics:** a high proportion of math aids and computer programs, and concepts, none of test processes and procedures, production processes and procedures, utilization, and cost and administrative action.
Q30 vs Q31	Essentiality of Information vs. Extensiveness of Information Use	2293.95	15	$\alpha < .0005$	0.462*	The more essential the information, the more extensive its use in the task. *Taken from two way table rather than from matrix

Table 5-19. SEARCH AND ACQUISITION vs TASK Correlation Matrix

		(Q48) User's Age	Highest Degree	(Q50C) Field of Degree	(Q50B) Year of Degree	(Q51) Job Experience	(Q52) Company Experience	(Q55) Kind of Position	(Q56) Field of Position	(Q58) Equivalent GS Rating	(Q49) Number of Personnel Supervised	(Q54) Type of Activity
Class of Information	(Q28)	.08	-.04	-.07	-.07	.01	.09	.12	-.11	.04	.09	.09
Field of Information	(Q29)	-.10	.07	.19	.12	-.04	-.09	-.18	.52	-.04	-.12	-.12
Desired Depth of Information Media	(Q25)	[illegible]	.07	.01	.01	.05	-.01	-.08	.01	.07	.05	.05
Desired Volume of Information Media	(Q22)	.02	.04	.02	-.01	.01	-.01	-.06	-.00	.07	.02	.05
Actual Depth of Information Media	(Q24)	.02	.07	.02	.00	.04	.02	-.07	.00	.06	.03	.06
Actual Volume of Information Media	(Q21)	.02	.00	-.01	-.03	-.01	-.01	-.03	-.01	.04	.01	.03
Desired Composition of Information Media	(Q20)	.01	.04	.01	.02	-.01	-.01	-.05	.01	.05	-.02	.02
Desired Layout of Information Media	(Q27)	-.01	.09	.02	.03	-.02	-.03	-.07	.00	.08	.04	.04
Actual Composition of Information Media	(Q18)	.02	.07	.02	.02	-.02	-.02	-.06	.02	.05	-.01	.02
Actual Layout of Information Media	(Q26)	.00	.08	.01	.02	-.01	-.04	-.06	-.01	.08	.05	.03
Usual Composition of Information Media	(Q19)	.02	.05	.05	.00	-.01	-.01	-.04	.00	.05	-.04	.01
Why Used First Source for Information	(Q15)	-.03	.02	.02	.03	.01	.00	-.02	.03	-.01	.01	.00
Location of First Source for Information	(Q14)	.03	.01	.01	-.03	-.01	.04	.01	.00	.07	.04	.07
Acquisition From First Source for Information	(Q17)	.02	-.07	-.03	-.03	.00	.06	.09	-.01	-.04	.04	.05
Desired Acquisition Time	(Q13)	.09	.20	.07	-.04	.05	.06	-.16	.04	.18	.04	.06
Actual Acquisition Time	(Q12)	.09	.13	.04	-.05	.06	.05	-.10	.01	.15	.07	.09
Essentiality of Information	(Q30)	.05	-.05	-.04	-.06	.06	.03	.00	-.03	.02	.02	.01
Usefulness of Title Listings or Abstracts	(Q23)	.01	.12	.07	.03	.02	-.06	-.13	.03	.11	-.01	.02
Discovery of Post Task Information	(Q32)	-.08	.00	.01	.06	-.01	-.07	-.05	.01	.00	.01	.07

SEARCH AND ACQUISITION Profile vs TASK Profile

The TASK question which shows a unique influence on SEARCH AND ACQUISITION is task duration (Table 5-20). It affects acquisition time (see Figure 5-60), volume and layout of information media, and usefulness of title listings or abstracts. The other interactions evidenced are reflections of the previously discussed associations among kind, class, and field of the two profiles. Table 5-21 presents a summary of the more significant two-way frequency distributions for SEARCH AND ACQUISITION vs TASK inter-relations.

SEARCH AND ACQUISITION Profile vs UTILIZATION Profile

There are no outstanding features between SEARCH AND ACQUISITION questions and UTILIZATION questions, except the interaction of title listing and abstract use and acquisition time with the use of information centers and services and the encounter of restrictions and difficulties (see Table 5-22).

Interviewer Assessment

The interviewer was asked to answer four questions at the end of each interview:

- Characterize the respondent's need for external information as insignificant, moderate or large (Q59).
- Was the method or procedure for the use of the needed information obvious, independent of professional judgment, dependent upon professional judgment, or difficult due to the lack of methods and procedures (Q61)?
- Was the method or procedure for obtaining the information quite obvious, fairly obvious, or not obvious (Q62)?
- How creative was the task: the communication of existing information; rearrangement of existing information; extensive evaluation and analysis of existing information; or creation of new information, systems or hardware (Q63)?

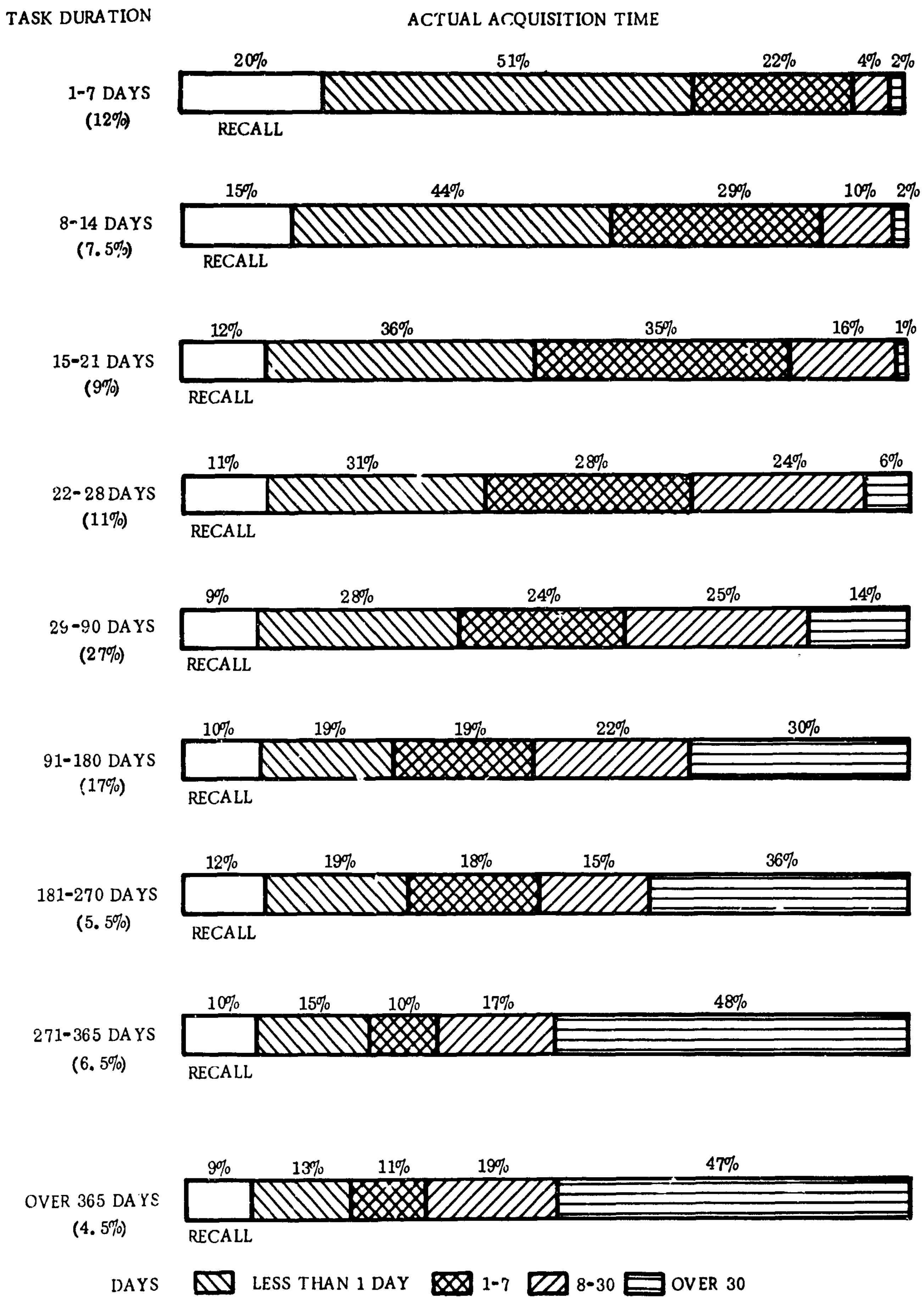
There is a relatively high association among these four questions (Table 5-23).

When considering the USER profile in relation to these questions, the dominant grouping is again the level of personnel (equivalent GS rating, highest degree, kind of position and type of activity). The higher level personnel are those who have the greater need for external information, use information in new ways, and are more creative. The aspect of lack of procedures for obtaining information is less influenced by this level of personnel grouping than the other assessment questions. (See Table 5-24.)

When considering the interaction of TASK questions with the interviewer's assessments, the level of personnel influence is carried over into TASK by the kind of task and class of task. Other items which interact with these assessments are task duration, formality of task output, and task recipient (all of which have been noted earlier as being related to level of personnel). (See Table 5-24.)

Table 5-20. SEARCH AND ACQUISITION vs. TASK Correlation Matrix

		(Q2) Task Initiator	(Q7) Task Recipient	(Q9) Kind of Task	(Q8) Class of Task	(Q10) Field of Task	(Q6) Formality of Task Output	(Q5) Type of Task Output	(Q3) Task Duration	(Q4) Percentage of Time on Task
Class of Information	(Q28)	.06	-.01	.11	.18	-.09	.01	.06	-.02	-.05
Field of Information	(Q29)	-.01	-.02	-.13	-.14	.59	-.08	-.13	.04	.09
Desired Depth of Information Media	(Q25)	-.02	.06	-.09	-.02	-.02	.06	.04	.05	.02
Desired Volume of Information Media	(Q22)	-.02	.02	-.05	-.03	-.02	.03	.01	.15	.00
Actual Depth of Information Media	(Q24)	-.05	.05	-.07	.01	-.02	.09	.04	.03	.02
Actual Volume of Information Media	(Q21)	.00	.01	-.01	-.02	-.01	.02	.01	.12	.02
Desired Composition of Information Media	(Q20)	.04	.02	-.07	-.01	.00	.00	.00	.04	.00
Desired Layout of Information Media	(Q27)	.02	.04	-.06	.03	.02	.02	.02	.10	-.01
Actual Composition of Information Media	(Q18)	.03	.04	-.08	-.03	.01	.03	-.02	.05	.02
Actual Layout of Information Media	(Q26)	.02	.03	-.05	.04	.01	.03	.03	.09	.00
Usual Composition of Information Media	(Q19)	-.02	.01	-.02	-.03	.01	.00	.01	.00	.00
Why Used First Source for Information	(Q15)	.00	.01	-.02	-.01	-.02	.02	.01	-.03	-.01
Location of First Source for Information	(Q14)	.08	.04	.01	.00	-.03	.03	.01	.07	-.03
Acquisition From First Source for Information	(Q17)	.04	-.03	.08	.05	.01	.00	-.01	-.11	-.01
Desired Acquisition Time	(Q13)	-.09	.08	-.15	-.04	.01	.08	-.01	.52	-.07
Actual Acquisition Time	(Q12)	-.02	.06	-.08	.00	-.03	.07	.00	.38	-.04
Essentiality of Information	(Q30)	-.01	.02	-.02	.00	-.03	.05	-.01	.03	.04
Usefulness of Title Listings or Abstracts	(Q23)	-.07	.06	-.17	-.07	.01	.08	.03	.11	-.02
Discovery of Post Task Information	(Q32)	-.00	.01	-.09	-.03	.02	.02	.00	.05	.04



*See Footnote 1 on page 5-49.

Figure 5-60. Task Duration vs Actual Acquisition Time *

Table 5-21. Significant SEARCH and ACQUISITION vs TASK Inter-Relations

Questions	Description	χ^2	df	α	r	Remarks
Q12 vs Q3	Actual Acquisition Time vs. Task Duration	1245.30	48	$\alpha < .0005$	.375	As could be expected, the longer tasks utilized more time to acquire information. The use of recall is basically stable regardless of task length, although there is a higher proportion for tasks of one week or less.
Q13 vs Q9	Desired Acquisition Time vs. Kind of Task	335.31	55	$\alpha < .0005$	-.154	The closer to nature the task, the more time allowed to get information. High and low proportion features: a. Recall: basic research high; production low. b. Less than 1 day: test or evaluation high; basic research low. c. 1-7 days: basic and applied research low. d. 8-30 days: basic research low. e. 30-90 days: customer relations, reliability and quality control and basic research high. f. Over 90 days: basic and applied research high.
Q14 vs Q3	Location of First Source for Information vs. Task Duration	337.48	112	$\alpha < .0005$	.065	The tendency is towards longer tasks using first sources that are more distant from the individual seeking information. High proportion features: a. Received with task assignment: 1-7 days. b. Recalled it: 1-7 days. c. Respondent's own action: 181-270 days. d. External consultant: 91-180 days, 181-270 days. e. DOD information systems: 270-365 days, 15-21 days. f. Customer: 21-30 days, 31-90 days
Q23 vs Q9	Usefulness of Title Listings or Abstracts vs. Kind of Task	274.91	22	$\alpha < .0005$	-.169	There is a tendency for those individuals on tasks farthest removed from nature (research), to use title listings and abstracts less. Use of title listings or abstracts has a high proportion of basic and applied research.
Q25 vs Q9	Desired Depth of Information Media vs. Kind of Task	103.84	22	$\alpha < .0005$	-.088	There is a slight trend which indicates that the farther from nature the kind of task, the less depth is desired. High proportion features: a. Once-over-lightly: customer relations, reliability and quality control, and test or evaluation. b. Specific answer: no significant differences. c. Detailed analysis: basic research.
Q28 vs Q9	Class of Information vs. Field of Task	1310.25	132	$\alpha < .0005$	.114	High proportion features: a. Concepts: research. b. Design or design techniques: engineering and operational development. c. Experimental processes and procedures: research and production end-items.

Table 5-21. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q28 vs Q9 (Cont)						d. Test process and procedures: test or evaluation. e. Evaluation: system analysis, and reliability and quality control. f. Specifications: reliability and quality control g. Production: production processes and end-items, and reliability and quality control. h. Technical status: customer relations.
Q28 vs Q10	Class of Information vs. Field of Task	1028.13	96	$\alpha < .0005$	-.091	High proportion features: a. Concept: physical science. b. Math aids and computer programs: mathematics, research (including computer science). c. Experimental processes and procedures: medical sciences, and chemical science and materials. d. Production: production, management and social sciences; and chemical science and materials. e. Technical status: medical sciences. f. Cost and administrative: production, management and social sciences, and mechanical industrial, civil, and marine engineering.

Table 5-22. SEARCH AND ACQUISITION vs. UTILIZATION Correlation Matrix

		(Q35) Use of Company TIC	(Q40) Use of DOD Specialized Information Centers	(Q41) Use of Other Specialized Information Centers	(Q38) Use of STAR	(Q44) Use of English Abstracts or Translations	(Q37) Use of TAB	(Q39) Use of DDC	(Q42) Encounter of Restrictions	(Q45) Encounter of Difficulties
Class of Information	(Q28)	-.03	.05	-.03	.00	-.04	-.03	-.03	.04	-.01
Field of Information	(Q29)	.03	-.02	-.07	.02	.07	.00	.04	-.03	-.01
Desired Depth of Information Media	(Q25)	.06	.04	.08	.06	.10	.03	.10	.03	.03
Desired Volume of Information Media	(Q22)	.04	.06	.00	.04	.03	.05	.03	.04	.06
Actual Depth of Information Media	(Q24)	.05	.01	.04	.05	.05	.02	.09	.02	.00
Actual Volume of Information Media	(Q21)	.02	.03	-.02	-.01	.01	.01	-.03	.01	.03
Desired Composition of Information Media	(Q20)	.05	.07	.06	.05	.07	.10	.11	.03	.03
Desired Layout of Information Media	(Q27)	.05	.09	.06	.09	.08	.07	.08	.05	.03
Actual Composition of Information Media	(Q18)	.07	.06	.05	.05	.07	.09	.11	.03	.00
Actual Layout of Information Media	(Q26)	.04	.09	.07	.08	.08	.06	.07	.05	.03
Usual Composition of Information Media	(Q19)	.04	-.02	.00	.01	.03	.01	.01	.00	.00
Who Used First Source for Information	(Q15)	.04	.06	.06	.03	.05	.04	.05	-.02	.00
Location of First Source for Information	(Q14)	.04	.11	.09	.05	.04	.07	.06	.07	.01
Acquisition From First Source for Information	(Q17)	-.07	-.04	-.05	-.04	-.07	-.07	-.07	-.05	-.12
Desired Acquisition Time	(Q13)	.11	.06	.08	.04	.14	.08	.11	.11	.09
Actual Acquisition Time	(Q12)	.08	.07	.07	.05	.07	.09	.09	.12	.09
Essentiality of Information	(Q30)	-.03	-.01	-.02	.01	-.04	-.01	-.02	.02	-.02
Usefulness of Title Listings or Abstracts	(Q23)	.22	.14	.10	.14	.17	.15	.13	.10	.08
Discovery of Post Task Information	(Q32)	.07	.10	.07	.02	.05	.05	.05	.06	.15

	(Q63) Task Creativity	(Q62) Difficulty in Acquisition of Information	(Q61) Difficulty in Use of Information
Information Needs of User (Q59)	.263	.330	.324
Task Creativity (Q63)		.287	.340
Difficulty in Acquisition of Information (Q62)			.432

Table 5-23. Interviewer Assessment Correlation Matrix

The interviewer assessments correlate fairly highly with UTILIZATION questions. People with the need for good information acquisition and use procedures are the ones who use formal information centers and services the most. The need for a large amount of external information is also associated with acquisition problems (restrictions, difficulties and discovery of post task information). (See Table 5-24.)

The greatest interaction among SEARCH AND ACQUISITION questions and the interviewer's assessments are the association of the use of title listings or abstracts with these assessments (Table 5-25).

Table 5-26 presents a summary of the more noteworthy two-way frequency distributions dealing with Interviewer Assessment intra-relations and inter-relations.

Table 5-24. Interviewer Assessment vs. USER, TASK and UTILIZATION Correlation Matrix

	(Q48) User's Age	(Q50A) Highest Degree	(Q50C) Field of Degree	(Q50B) Year of Degree	(Q51) Job Experience	(Q52) Company Experience	(Q55) Kind of Position	(Q56) Field of Position	(Q58) Equivalent GS Rating	(Q49) Number of Personnel Supervised	(Q54) Type of Activity	(Q2) Task Initiator	(Q7) Task Recipient	(Q9) Kind of Task	(Q8) Class of Task
Interviewer Assessment of Information Needs of User (Q60)	.101	.265	.137	.015	.142	.018	-.321	.021	.289	.099	.142	-.105	.137	-.297	-.075
Interviewer Assessment of Task Creativity (Q63)	.054	.214	.084	.036	.126	.007	-.209	.045	.214	.085	.117	-.069	[illegible]	-.232	-.224
Interviewer Assessment of Difficulty in Acquisition of Information (Q62)	-.009	.126	.087	.070	.063	-.015	-.167	.017	.075	.003	.035	-.098	.048	-.179	-.102
Interviewer Assessment of Use of Difficulty in Information (Q61)	.006	.194	.116	.009	.126	.040	-.199	.020	.212	.046	.091	-.105	.099	-.244	-.151

	(Q10) Field of Task	(Q6) Formality of Task Output	(Q5) Type of Task Output	(Q3) Task Duration	(Q4) Percentage of Time on Task	(Q35) Use of Company TIC	(Q40) Use of DOD Specialized Information Centers	(Q41) Use of Other Specialized Information Centers	(Q36) Use of STAR	(Q44) Use of English Abstracts or Translations	(Q37) Use of TAB	(Q39) Use of DDC	(Q42) Encounter of Restrictions	(Q45) Encounter of Difficulties
Interviewer Assessment of Information Needs of User (Q60)	-.010	.097	.032	.141	-.058	.332	.206	.198	.212	.312	.293	.305	.174	.178
Interviewer Assessment of Task Creativity (Q63)	.021	.150	-.042	.203	.023	.149	.087	.072	.058	.191	.095	.204	.038	.001
Interviewer Assessment of Difficulty in Acquisition of Information (Q62)	.022	.098	.030	.072	-.017	.129	.142	.040	.111	.144	.136	.171	.072	.069
Interviewer Assessment of Use of Difficulty in Information (Q61)	.025	.050	.020	.167	.005	.202	.146	.049	.103	.215	.164	.242	.128	.072

Table 5-25. Interviewer Assessment vs. SEARCH AND ACQUISITION Correlation Matrix

	(Q28) Class of Information	(Q29) Field of Information	(Q25) Desired Depth of Information Media	(Q22) Desired Volume of Information Media	(Q24) Actual Depth of Information Media	(Q21) Actual Volume of Information Media	(Q20) Desired Composition of Information Media	(Q27) Desired Layout of Information Media	(Q18) Actual Composition of Information Media	(Q26) Actual Layout of Information Media	(Q19) Usual Composition of Information Media	(Q15) Why Used First Source for Information	(Q14) Location of First Source for Information	(Q17) Acquisition from First Source for Information	(Q13) Desired Acquisition Time	(Q12) Actual Acquisition Time	(Q30) Essentiality of Information	(Q23) Usefulness of Title Listings or Abstracts	(Q32) Discovery of Post Task Information
Interviewer Assessment of Information Needs of User (Q59)	-.011	.043	.121	.109	.078	.070	.107	.104	.116	.094	.014	-.016	.104	.118	.196	.183	.021	.236	.144
Interviewer Assessment of Task Creativity (Q63)	-.034	.087	.145	.024	.120	-.009	.029	.065	.051	.051	-.030	.080	.040	-.027	.140	.131	.026	.132	-.005
Interviewer Assessment of Difficulty in Acquisition of Information (Q62)	.001	.043	.089	.040	.067	-.019	.051	.054	.043	.055	-.010	.022	.070	-.111	.083	.095	-.012	.130	.109
Interviewer Assessment of Difficulty in Use of Information (Q61)	-.044	.046	.055	.070	.027	.019	.093	.040	.079	.034	.006	-.006	.098	-.100	.145	.119	.002	.128	.087

Table 5-26. Significant Interviewer Assessment Intra-Relations and Inter-Relations

Questions	Description	X^2	df	α	r	Remarks
Q9 vs Q61	Kind of Task vs. Interviewer Assessment of Difficulty in Use of Information	118.61	33	$\alpha < .0005$	-.244	There is a tendency for use of information to be difficult for tasks close to nature (research), and obvious or prescribed for tasks furthest from nature (customer relations). Of notable interest is the fact that for tasks involving development of operational systems, methods for using the information tend to be obvious or prescribed.
Q9 vs Q62	Kind of Task vs. Interviewer Assessment of Difficulty in Acquisition of Information	75.08	22	$\alpha < .0005$	-.179	An interesting feature is that for both applied and basic research, methods for acquisition of information tends to be neither clear nor obvious.
Q9 vs Q63	Kind of Task vs. Interviewer Assessment of Task Creativity	202.91	33	$\alpha < .0005$	-.232	The closer the kind of task to nature, the more likely it involves creation of new information, systems, or hardware. Some interesting features are: a. Basic research: a high proportion in creation of new information, systems, or hardware. b. System analysis: a high proportion in extensive evaluation and analysis of existing data. c. Customer relations: a high proportion in tasks consisting of rearrangement of existing information, with little evaluation or analysis. d. Production processes, production end-items, and reliability and quality control: a high proportion in tasks involving only communication of existing information.
Q35 vs Q59	Use of Company TIC vs. Interviewer Assessment of Information Needs of User	221.94	6	$\alpha < .0005$	.332	The tendency is for persons assessed as having a large information need to use TIC more frequently than those with a lesser need.
Q37 vs Q59	Use of TAB vs. Interviewer Assessment of Information Needs of User	169.63	8	$\alpha < .0005$	.293	Respondents with large external information needs tend to know and use TAB more than those with lesser needs. However, the following features should be noted: a. Some 27% of respondents with a large need and 44% of those with moderate needs do not know of TAB. b. Some 24% of respondents with a large need and 24% of those with a moderate need know of TAB but do not use it.
Q39 vs Q59	Use of DDC vs. Interviewer Assessment of Information Needs of User	191.40	4	$\alpha < .0005$	.305	There is a moderate tendency toward the greater the respondent's need for information, the greater his knowledge of and use of DDC.

Table 5-26. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q50A vs Q59	User's Highest Degree vs. Interviewer Assessment of Information Needs of User	141.64	10	$\alpha < .0005$	.265	Tendency for respondents with higher degrees to have a greater information requirement.
Q50A vs Q63	User's Highest Degree vs. Interviewer Assessment of Task Creativity	107.45	15	$\alpha < .0005$	.218	Two interesting features are: a. Doctors have a high proportion of tasks which are mostly creation of new information, systems, or hardware b. A high proportion of respondents with no degree perform tasks which consist of communication or rearrangement of existing information with little evaluation or analysis.
Q55 vs Q59	User's Kind of Position vs. Interviewer Assessment of Information Needs of User	222.41	22	$\alpha < .0005$	-.321	There is a tendency for activities closer to nature to have a larger information requirement. Both applied and basic research have a large proportion of respondents with large external information needs; while respondents in operational development, test or evaluation, production processes, and production end-items tend to have an insignificant need for such information.
Q61 vs Q62	Interviewer Assessment of Difficulty in Use of Information vs. Interviewer Assessment of Difficulty in Acquisition of Information	462.59	6	$\alpha < .0005$	.482	There is a tendency for that information which is easy to acquire to be easy to use.

6. RELATIONSHIPS AND FACTORS

The previous section described two-question interactions in considerable detail via two-way frequency distributions and the complete correlation matrix. This section presents a treatment of interactions among questions which is simultaneously more comprehensive, as it focuses upon multi-question interactions, and more comprehensible, as it filters out nonessential details in the focusing process. To make such a treatment possible, however, requires the relationship analysis cycle. Section 4 presents a complete discussion of the relationship analysis cycle, including the definitions of terms which are used in this section, and should be consulted.

Qualitative question responses are transformed into numerical form via the development of a detailed structure, and the definition of a numerical description for that structure. A detailed structure is the arrangement of each question's responses into an informative order, and a numerical description of that structure is the association of a number with each question response. Groups of related questions are then arranged into an informative and unifying order to form a general structure. In order to simplify the specification and estimation of models for multi-question relationships, pairs of related questions are combined.

Linear models for relationships among combinations of questions in the general structure are next specified by representing each combination of questions as a linear function of those combinations of questions which are judged potentially related to it. No distinction is made, as in the previous section, between intra-relations and inter-relations. The unspecified constants or coefficients in these linear models, and thereby the linear models themselves, are estimated from the data in numerical form via stepwise regression analysis.

Volume III presents the results of the stepwise regression analysis. It contains, in addition to the estimated constants and linear models for relationships, an indication of the significance of a relationship and the contribution of question combinations to the relationship. An analysis and interpretation of the stepwise regression results yields the discussion of relationships and factors which follows. In this discussion, one must bear in mind both the advantages and disadvantages of characterizing combinations of questions as input factors and output factors (see Section 4).

6.1 RELATIONSHIPS

A question combination is said to be related to a given combination of questions when it is included in the relationship at the effective step, is said to make a significant contribution to the relationship when its F to remove at that step is between 30 and 90, and is said to make a highly significant contribution to the relationship when its F to remove at that step is at or above 90. If the multiple correlation is at or above .40 in absolute value, then the relationship is called significant. Some question combinations which have a potential F to enter at or above 6.66 at the effective step are called candidates for the relationship. Those whose potential F to enter at that step is at or above 30 are said to potentially make a significant contribution to the relationship.

Summaries of the pertinent relationship results for the USER, TASK, UTILIZATION, and SEARCH AND ACQUISITION components or profiles appear in Tables 6-1 through 6-4, respectively. Table 6-5 presents the corresponding results for interviewer assessments. For each combination of questions in the general structure,

including the four special indices defined to summarize components, the tables contain:

- Those question combinations which were judged to be potentially related to it, in order by component.
- Those question combinations which are related to it, ranked in order of their contribution to the relationship.
- An indication of those question combinations whose coefficients are negative, those question combinations which make a significant contribution to the relationship, those question combinations which make a highly significant contribution the relationship, and those relationships which are significant.
- Those question combinations which are candidates for the relationship, ranked in order of their potential contribution to the relationship.
- An indication of those question combinations which potentially make a significant contribution to the relationship.

The tables describe relationship results in an easily comprehended format. An example is provided by the user's field of position (Q56) in Table 6-1. The user's age (Q48), highest degree (Q50A), field of degree (50C), and experience (1/2 (Q51 + Q52)) were judged potentially related to Q56. In the regression analysis of the linear model for Q56, it was determined that the related questions (ranked by their contribution to the relationship) are the user's field of degree, highest degree, and age. It was also determined that the user's kind of position (Q55) is a candidate for the relationship. The footnotes indicate that the user's field of degree makes a highly significant contribution to the relationship, and that the coefficients of both the user's highest degree and age are negative. However, the most pertinent results are now briefly commented upon.

Although the user's highest degree is not related to his age, his field of degree is highly related to it (with a negative coefficient). The user's highest degree, experience, and age make significant contributions to the relationship for the user's level. Variation in the user's kind of position and field of position are well explained by variation in his highest degree and field of degree, respectively.

The kind and class of the task are highly related to the user's kind of position; and the field of the task is highly related to the user's field of position. Variation in the form of the task output is well explained by variation in the user's level. The kind and class of the task (with a negative coefficient) make a significant contribution to the relationship for task time.

Variation in the use of both the company TIC and specialized information services are well explained by variation in the user's kind of position (with a negative coefficient). On the other hand, the use of specialized information centers is highly related to the user's level. The use of specialized information centers and services and the user's kind of position (with a negative coefficient) make a significant contribution to the relationship for the use of DDC; but only the use of specialized information services makes a significant contribution to the relationship for the use of TAB. Variation in utilization effort is well explained by variation in the user's kind of position (with a negative coefficient) and highest degree.

Table 6-1. USER Relationships

User Characteristic	Judged Potentially Related To	Related to[A]	Candidate for Relationship[F]
User's highest degree (Q50A)	User's age (Q48)		
User's field of degree (Q50C)	User's age	User's age[B, C]	User's highest degree[G]
User's experience (1/2(Q51+Q52))	User's age	User's age[D, E]	User's highest degree
User's kind of position (Q55)	User's age, highest degree, field of degree, and experience	User's highest degree[B, D]	
User's field of position (Q56)	User's age, highest degree, field of degree, and experience	User's field of degree,[D] highest degree,[B] and age[B]	User's kind of position
User's level (1/2(Q49+Q58))	User's age, highest degree, field of degree, experience, kind of position, and field of position	User's highest degree,[D] experience,[C] age,[C] and field of position[B, E]	

A. Are ranked in order of contribution to the relationship.

B. Coefficient is negative (all other coefficients being positive).

C. Makes a significant contribution to the relationship.

D. Makes a highly significant contribution to the relationship.

E. Relationship is significant.

F. Are ranked in order of potential contribution to the relationship.

G. Would potentially make a significant contribution to the relationship.

Table 6-2. TASK Relationships

Task Characteristic	Judged Potentially Related to	Related to^{A}	Candidate for Relationship^{F}
Task direction (1/2(Q2+Q7))	User's kind of position, field of position, and level		
Kind and class of task (1/2(Q8+Q9))	User's kind of position, field of position, and level; and task direction	User's kind of position^{D}, and field of position^{B,E}	
Field of task (Q10)	User's kind of position, field of position, and level; and task direction	User's field of position^{D,E}	
Form of task output (1/2 (Q5 + Q6))	User's kind of position, field of position, and level; and task direction, kind and class of task, and field of task	User's level,^{C} field of task,^{B} and task direction	User's highest degree
Task time (Q3Q4)	User's kind of position, field of position, and level; and task direction, kind and class of task, field of task, and form of task output	Kind and class of task,^{B,D} user's kind of position,^{B} and task direction	User's highest degree
User-task flexibility (F= 1/2(| Q9-Q55 | + | Q10-Q56 |))	User's highest degree, field of degree, kind of position, field of position, and level	User's kind of position and field of position^{B}	

A. Are ranked in order of contribution to the relationship.

B. Coefficient is negative (all other coefficients being positive).

C. Makes a significant contribution to the relationship.

D. Makes a highly significant contribution to the relationship.

E. Relationship is significant.

F. Are ranked in order of potential contribution to the relationship.

G. Would potentially make a significant contribution to the relationship.

Table 6-3. UTILIZATION Relationships

Utilization Characteristic	Judged Potentially Related To	Related to[A]	Candidate for Relationship[F]
Use of company TIC (Q33Q35)	User's highest degree, field of degree, kind of position, field of position, and level	User's kind of position,[B,C] and highest degree[C]	
Use of specialized information centers (1/2(Q40+Q41))	User's highest degree, field of degree, kind of position, field of position, and level	User's level,[C] highest degree, and kind of position[B]	Use of company TIC[G]
Use of specialized information services (1/2(Q38+Q44))	User's highest degree, field of degree, kind of position, field of position, and level	User's kind of position,[B,C] highest degree,[C] and level	Use of company TIC,[G] and specialized information centers[G]
Use of TAB (Q37)	User's highest degree, field of degree, kind of position, field of position, and level; and use of company TIC, specialized information centers, and specialized information services	Use of specialized information services and centers,[D] and company TIC; and user's kind of position[B,E]	
Use of DDC (Q39)	User's highest degree, field of degree, kind of position, field of position, and level; and use of company TIC, specialized information centers, and specialized information services	Use of specialized information centers,[C] user's kind of position,[B,C] use of specialized information services,[C] use of company TIC, and user's level[C,E]	Use of TAB[G]
Utilization Restrictions (Q42Q43)	User's highest degree, field of degree, kind of position, field of position, and level; and use of company TIC, specialized information centers, specialized information services, and TAB and DDC	Use of TAB and DDC,[D] and user's level	
Utilization Difficulties (Q45Q46)	User's highest degree, field of degree, kind of position, field of position, and level; and use of company TIC, specialized information centers, specialized information services, and TAB and DDC	Use of specialized information centers,[D] and user's highest degree	Utilization restrictions

Table 6-3 (Cont)

Utilization Characteristic	Judged Potentially Related To	Related to[A]	Candidate for Relationship[F]
Utilization effort ($E = 1/4 (Q33Q35+1/2(Q40+Q41)+1/2(Q38+Q44)+1/2(Q37+Q39))$)	User's highest degree, field of degree, kind of position, field of position, and level	User's kind of position,[B, D] highest degree,[C] and level[C, E]	Interviewer Assessment of Information needs of user [G]
Utilization problems ($P= 1/2(Q42Q43+Q45Q46)$)	User's highest degree, field of degree, kind of position, field of position, and level	User's highest degree, kind of position,[B] and level	Utilization effort,[G] and interviewer assessment of information needs of user[G]

A. Are ranked in order of contribution to the relationship.

B. Coefficient is negative (all other coefficients being positive).

C. Makes a significant contribution to the relationship.

D. Makes a highly significant contribution to the relationship.

E. Relationship is significant.

F. Are ranked in order of potential contribution to the relationship.

G. Would potentially make a significant contribution to the relationship.

Table 6-4. SEARCH AND ACQUISITION Relationships

Search and Acquisition Characteristic	Judged Potentially Related To	Related To^A	Candidate For Relationship^F
Desired class of information (Q16)	User's kind of position, field of position, and level; and kind and class of task, field of task, form of task output, and task time	Kind and class of task,^{C} user's level,^{C} field of task,^{B} and form of task output	
Class of information (Q28)	Kind and class of task, field of task, form of task output, and task time; and desired class of information, location of and acquisition from first source for information, actual content of information media, and actual form of information media	Kind and class of task,^{D} desired class of information,^{D} and form of task output	User's field of position, and location of and why used first source for information (1/2(Q14+Q15))
Field of information (Q29)	Kind and class of task, field of task, form of task output, and task time; and desired class of information, location of and acquisition from first source for information, actual content of information media, and actual form of information media	Field of task,^{D} desired class of information,^{B} form of task output,^{B} and kind and class of task$^{B, E}$	Class of information^G
Desired content of information media (1/2(Q22+Q25))	User's kind of position, field of position, and level; kind and class of task, field of task, form of task output, task time, and user-task flexibility; utilization effort; and desired class of information	Task time,^{C} utilization effort, user's level, kind and class of task,^{B} and form of task output	
Actual content of information media (1/2(Q21+Q24))	Kind and class of task, field of task, form of task output, task time, and user-task flexibility; utilization effort; and desired class of information, desired content of information media, desired form of information media, and location of and acquisition from first source for information	Desired content of information media,^{D} utilization effort,^{B} desired form of information media, and location of and acquisition from first source for information^E	
Desired form of information media (1/2(Q20+Q27))	User's kind of position, field of position, and level; kind and class of task, field of task, form of task output, and task time; utilization effort; and desired class of information, and desired content of information media	Desired content of information media,^{D} utilization effort,^{C} task time, and user's kind of position^B	

Table 6-4 (Cont)

Search and Acquisition Characteristic	Judged Potentially Related To	Related to^{A}	Candidate For Relationship^{F}
Actual form of information media (1/2(Q18+Q26))	Kind and class of task, field of task, form of task output, and task time; utilization effort; and desired class of information, desired form of information media, location of and acquisition from first source for information, and actual content of information media	Desired form of information media,^{D} actual content of information media,^{C} utilization effort,^{C} task time, desired class of information,^{B} location of and acquisition from first source of information,^{B} and form of task output^{E}	
Location of first source for information (Q14)	User's kind of position, field of position, and level; task direction, kind and class of task, field of task, form of task output, task time, and user-task flexibility; utilization effort; and desired class of information, desired content of information media, desired form of information media, and why used first source for information (Q15)	Why used first source for information,^{C} desired form of information media,^{C} desired content of information media,^{C} task direction,^{C} utilization effort, and user's kind of position	Class of information
Acquisition from first source for information (Q17)	User's kind of position, field of position and level; kind and class of task, field of task, form of task output, task time, and user-task flexibility; utilization effort and utilization problems; and desired class of information, desired content of information media, desired form of information media, and location of and why used first source for information	Desired form of information media,^{B,D} desired content of information media,^{B,C} utilization problems,^{B} and task time^{B}	
Desired acquisition time (Q13)	User's kind of position, field of position, and level; kind and class of task, field of task, form of task output, and task time; utilization effort; and desired class of information, desired content of information media, desired form of information media, and location of and why used first source for information	Task time,^{D} user's level,^{C} desired content of information media,^{C} desired form of information media,^{C} user's kind of position,^{B} desired class of information, location of and why used first source for information, and utilization effort^{E}	Task direction, and utilization problems

Table 6-4 (Cont)

Search and Acquisition Characteristic	Judged Potentially Related To	Related To^{A}	Candidate For Relationship^{F}
Actual acquisition time (Q12)	User's kind of position, field of position and level; kind and class of task, field of task, form of task output, task time, and user-task flexibility; utilization effort; and location of and acquisition from first source for information, actual content of information media, actual form of information media, class of information, and field of information	Task time,^{D} actual form of information media,^{D} user's level,^{C} actual content of information media, utilization effort, and field of task^{B}	Desired acquisition time,^{G} location of and why used first source for information,^{G} utilization problems, and desired class of information
Contribution of information to task (1/2(Q30-Q31))	Kind and class of task, field of task, form of task output, and task time; and location of and acquisition from first source for information, actual content of information media, actual form of information media, class of information, field of information, and actual acquisition time	Actual content of information media,^{C} and actual form of information media^{B}	Location of and why used first source for information, and desired class of information
Usefulness of title listings or abstracts (Q23)	User's kind of position, field of position, and level; kind and class of task, field of task, form of task output, task time, and user-task flexibility; utilization effort; and desired class of information, desired content of information media, desired form of information media, location of and why used first source for information, and desired acquisition time	Desired form of information media,^{D} utilization effort,^{D} desired content of information media,^{C} kind and class of task,^{B} location of and why used first source for information, form of task output, and desired class of information$^{B, F}$	Task direction
Discovery of pr[illegible] information ([illegible])	User's kind of position, field of position, and level; kind and class of task, field of task, form of task output, task time, and user-task flexibility; utilization effort and utilization problems; and desired class of information, desired content of information media, desired form of information media, location of and why used first source for information, and desired acquisition time	Utilization problems,^{C} kind and class of task,^{B} utilization effort, desired content of information media, and desired form of information media	

Table 6-4. (Cont)

Search and Acquisition Characteristic	Judged Potentially Related To	Related To^A	Candidate For Relationship^F
Inadequacy of search and acquisition process $(I=1/6(\lvert Q16-Q28\rvert+\lvert 1/2(Q22+Q25)-1/2(Q21+Q24)\rvert+\lvert 1/2(Q20+Q27)-1/2(Q18+Q26)\rvert+(1-Q17)+\lvert Q13-Q12\rvert+Q32))$	User's kind of position, field of position, and level; kind and class of task, field of task, form of task output, task time, and user-task flexibility; and utilization effort, and utilization problems	Task time,^{C} utilization problems, kind and class of task,^{B} and utilization effort	Contribution of information to task,^{G} and location of first source for information

A. Are ranked in order of contribution to the relationship.

B. Coefficient is negative (all other coefficients being positive).

C. Makes a significant contribution to the relationship.

D. Makes a highly significant contribution to the relationship.

E. Relationship is significant.

F. Are ranked in order of potential contribution to the relationship.

G. Would potentially make a significant contribution to the relationship.

Table 6-5. Interviewer Assessment Relationships

Interviewer Assessment Characteristic	Judged Potentially To	Related to[A]	Candidate for Relationship[F]
Interviewer assessment of information needs of user (Q59)	User's highest degree, field of degree, kind of position, field of position, and level; and use of company TIC, specialized information centers, specialized information services, and TAB and DDC	User's kind of position,[B,C] use of company TIC,[C] use of specialized information centers,[C] user's level, use of specialized information services, and use of TAB and DDC[E]	
Interviewer assessment of task creativity (Q63)	User's highest degree, field of degree, kind of position, field of position, and level; and task direction, kind and class of task, field of task, form of task output, and task time	Kind and class of task,[B,C] task time, user's level, user's kind of position,[B] and user's highest degree	
Interviewer assessment of difficulty in acquisition and use of information (1/2(Q61+Q62))	User's kind of position, field of position and level; kind and class of task, field of task, form of task output, and task time; and desired class of information, desired content of information media, desired form of information media, location of and why used first source for information, and desired acquisition time	Kind and class of task,[B,C] desired form of information media,[C] user's kind of position,[B] form of task output, user's level, and desired acquisition time	Utilization effort,[G] discovery of post task information,[G] utilization problems,[G] usefulness of title listings or abstracts,[C] and task direction

A. Are ranked in order of contribution to the relationship.

B. Coefficient is negative (all other coefficients being positive).

C. Makes a significant contribution to the relationship.

D. Makes a highly significant contribution to the relationship.

E. Relationship is significant.

F. Are ranked in order of potential contribution to the relationship.

G. Would potentially make a significant contribution to the relationship.

The class and field of the information are highly related to the kind and class of the task, and the field of the task, respectively. Task time makes a significant contribution to the relationship for the desired content of the information media; while both the desired content of the information media and utilization effort make significant contributions to the relationship for the desired form of the information media. The location of the first source for the information is highly related to why the first source was used, the desired form and content of the information media, and the task direction. Variation in acquisition from the first source for the information is well explained by variation in the desired form and content of the information media (with a negative coefficient). Task time, the user's level, and the desired form and content of the information media make a significant contribution to the relationship for desired acquisition time; while task time, the actual form of the information media, and the user's level make a significant contribution to the relationship for actual acquisition time. The usefulness of title listings or abstracts is highly related to the desired form and content of the information media, and utilization effort. On the other hand, variation in the discovery of post task information is well explained by variation in utilization problems. Task time makes a significant contribution to the relationship for inadequacy of the search and acquisition process.

In addition, the candidates for relationships indicate that:

- The potential relationship of some related pairs of questions, although ignored for simplicity, is reasonable.
- The potential relationship among some uses of information centers and services, although ignored for simplicity, is reasonable.
- The potential switch of desired class of information and class of information in their relationships to some SEARCH and ACQUISITION characteristics is interesting.
- The potential relationship of the user's highest degree to some USER and TASK characteristics was underestimated.
- The potential relationship of task direction to some SEARCH AND ACQUISITION characteristics was underestimated.
- The potential relationship of utilization problems to some SEARCH AND ACQUISITION characteristics was underestimated.
- The potential relationship of why used first source for information to some SEARCH AND ACQUISITION characteristics was underestimated.

6.2 INPUT AND OUTPUT FACTORS

An additional analysis of the relationship results in Tables 6-1 through 6-5 ranks question combinations, from the most often and most significantly related to the least often and least significantly related, to combinations of questions in each component of the flow process and the flow process itself. That is, question combinations are ranked, from the most useful and most significant to the least useful and least significant contributors to explaining the variation in the answers to the appropriate collection of combinations of questions. The ranking procedure is, of course, based upon the number of combinations of questions in the appropriate

collection to which a given question combination is related, and the significance of its contribution to the relationship.*

The ranking procedure is best introduced by an example. As indicated above, the user's field of position (Q56) is related to (in order of their contribution to the relationship) the user's field of degree (Q50C), highest degree (Q50A), and age (Q48); and the user's kind of position (Q55) is a candidate for the relationship. The values assigned to these questions are: 0 for Q56 itself, 1 for Q50C, 2 for Q50A, 3 for Q48, and 4 for Q55. The 0 for Q56 indicates the trivial fact that Q56 makes the most significant contribution to explaining its own variation. All other question combinations are assigned a value of 12.

In general the ranking procedure assigns a value, according to the order of appearance in Tables 6-1 through 6-4, as follows: 0 to the combination of questions in the CHARACTERISTIC column, 1 to the 1st question combination, 2 to the 2nd question combination, ... m to the last question combination in the RELATED TO column; m+1 to the 1st question combination, m+2 to the 2nd question combination, ..., $p \leq 11$ to the last question combination in the CANDIDATE FOR RELATIONSHIP column; and 12 to those question combinations which do not appear, although they might have appeared according to the general structure and the input/output view of the flow process.

The sum of these numerical values is computed for a question combination over each component, and over their aggregate for the flow process. Then the sums for each component and those for the flow process are ranked among themselves, in the order of increasing size.

There were only a few ambiguities present in computing the sums. They involved questions which occurred in relationship models both alone and in question combinations. An example is provided by the use of TAB (Q37), and the use of DDC (Q39). These two questions are combined most of the time in relationship models as 1/2 (Q37 + Q39), but Q37 appears alone in the model for Q39. The question combination, 1/2 (Q37 + Q39), is considered to represent Q37, Q39 and itself. If a question occurs both alone and in a question combination, it is associated with the appropriate question combination which contains it. This also applies to the location of first source for information (Q14), why used first source for information (Q15) and acquisition from first source for information (Q17).

Tables 6-6 through 6-9 contain the results of the ranking procedure for the USER, TASK, UTILIZATION, and SEARCH AND ACQUISITION components, respectively. In Addition, Table 6-9 contains the results for the flow process.

An example is provided by the user's highest degree (Q50A) in Table 6-6. It received a: 0 for its contribution to itself, 2 for its contribution to the user's field of degree (Q50C), 2 for its contribution to the user's experience (1/2 (Q51 + Q52)), 1 for its contribution to the user's kind of position (Q55), 2 for its contribution to the user's field of position (Q56), and 1 for its contribution to the user's level (1/2 (Q49 + Q58)). The sum of these values over the USER component is 8, which is the smallest such sum. Hence, the user's highest degree ranks first in its contribution to the relationships in the USER component (see Figure 6-2).

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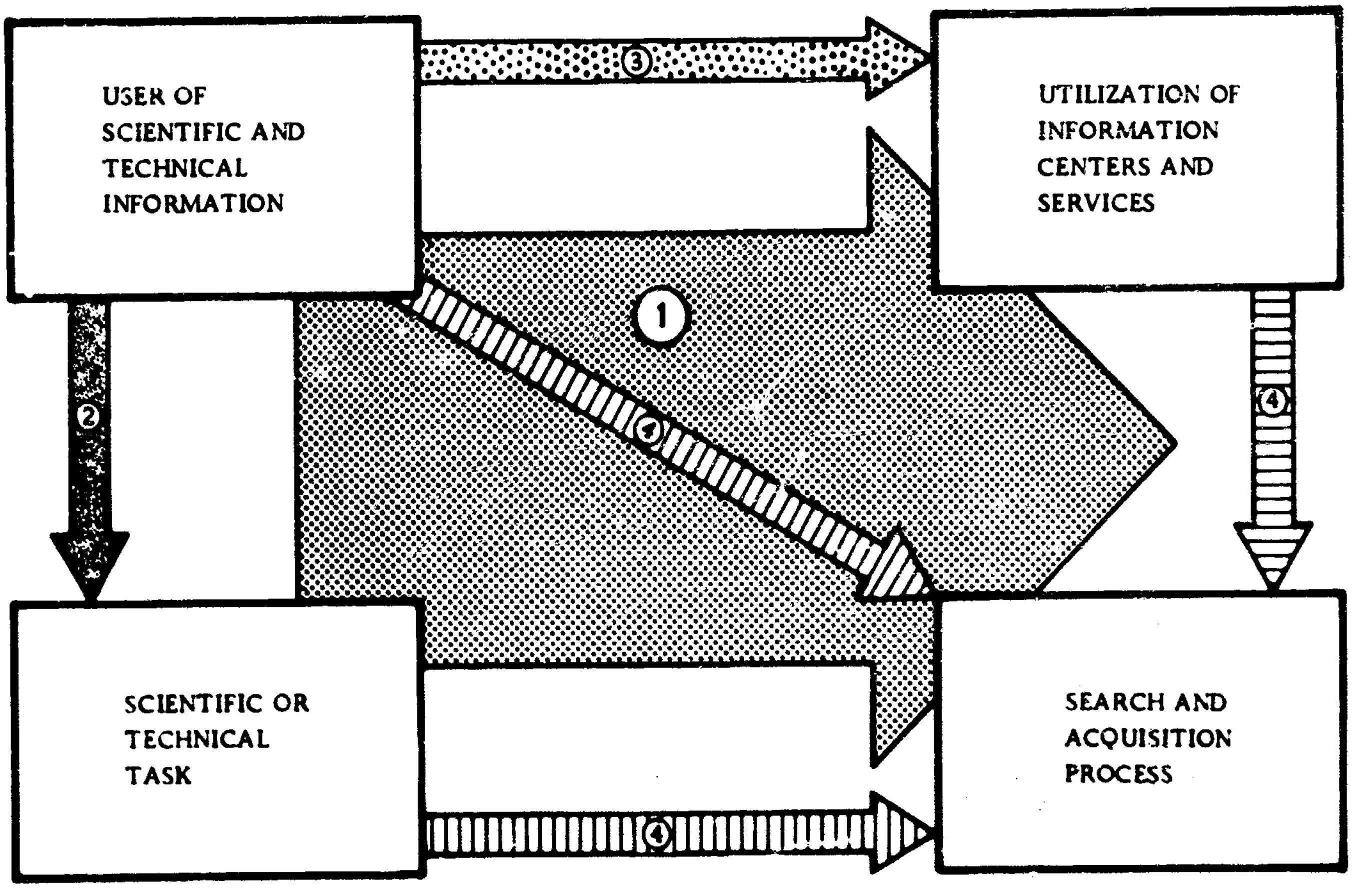
*An improvement of the procedure could also incorporate the significance of the relationship itself.

Examination of Tables 6-6 through 6-9 produces the input factors (combinations of questions that tend to influence) in the order of their importance. Examination of the general structure from an input/output point of view produces the corresponding output factors (combinations of questions which tend to be influenced). As remarked above, one must bear in mind both the advantages and disadvantages of characterizing combinations of questions as input factors and output factors (see Section 4).

Figure 6-1 depicts the input/output relations for the flow process. The input and output factors for the respective components appear in Figures 6-2 through 6-5. In Figure 6-6, the input and output factors for the flow process are presented. Due to a refinement of the ranking procedure, there are some minor differences between the order of input factors in these figures and the order in Appendix 2 of Volume I.



*The arrows point from input (tending to influence) to output (tending to be influenced).

Figure 6-1. Input/Output Relations for the Flow Process*

Table 6-6. USER Ranks*

Combination of Questions / Related Question Combinations	User's Age (Q48)	User's Highest Degree (Q50A)	User's Field of Degree (Q50C)	User's Experience (1/2(Q51+Q52))	User's Kind of Position (Q55)	User's Field of Position (Q56)	User's Level (1/2(Q49 + Q58))
User's Highest Degree (Q50A)		0					
User's Field of Degree (Q 50C)	1	2	0				
User's Experience (1/2(Q51+Q52))	1	2		0			
User's Kind of Position (Q55)		1			0		
User's Field of Position (Q56)	3	2	1		4	0	
User's Level (1/2(Q49+Q58))	3	1		2		4	0
Question Combination Column Total	32	8	49	50	52	52	60
Question Combination Rank	2	1	3	4	5-1/2	5-1/2	7

*Table entries are assigned, according to order of appearance in Table 1-4, as follows: 0 to combination of questions in CHARACTERISTIC column: 1 to 1st question combination, 2 to 2nd question combination, . . . , m to last question combination in RELATED TO column; m+1 to 1st question combination, m+2 to 2nd question combination, . . . , p ≤11 to last question combination in CANDIDATE FOR RELATIONSHIP column; and 12, which is omitted for simplicity, to those question combinations not appearing.

Table 6-7. TASK Ranks*

Combination of Questions \\ Related Question Combinations		User's Age (Q48)	User's Highest Degree (Q50A)	User's Field of Degree (Q50C)	User's Experience (1/2(Q51+Q52))	User's Kind of Position (Q55)	User's Field of Position (Q56)	User's Level (1/2(Q49+Q58))	Task Direction (1/2(Q2+Q7))	Kind and Class of Task (1/2(Q8+Q9))	Field of Task (Q10)	Form of Task Output (1/2(Q5+A6))	Task Time (Q3·Q4)	User-Task Flexibility (F = 1/2(|Q9-Q55|+|Q10-Q56|))
Task Direction	(1/2 (Q2 + Q7))								0					
Kind and Class of Task	(1/2 (Q8 + Q9))					1	2			0				
Field of Task	(Q10)						1				0			
Form of Task Output	(1/2 (Q5 + Q6))		4					1	3		2	0		
Task Time	(Q3 · Q4)		4			2			3	1			0	
User-Task Flexibility (F = 1/2 (|Q9 - Q55| + |Q10 - Q56|))	(QF)					1	2							0
Question Combination Column Total		72	56	72	72	40	41	61	42	49	50	60	60	60
Question Combination Rank		11	6	11	11	1	2	9	3	4	5	8	8	8

*Table entries are assigned, according to order of appearance in Table 6-2, as follows: 0 to combination of questions in CHARACTERISTIC column; 1 to 1st question combination, 2 to 2nd question combination, ..., m to last question combination in RELATED TO column; m+1 to 1st question combination, m+2 to 2nd question combination, ..., p ≤11 to last question combination in CANDIDATE FOR RELATIONSHIP column; and 12, which is omitted for simplicity, to those question combinations not appearing.

Table 6-8. UTILIZATION Ranks*

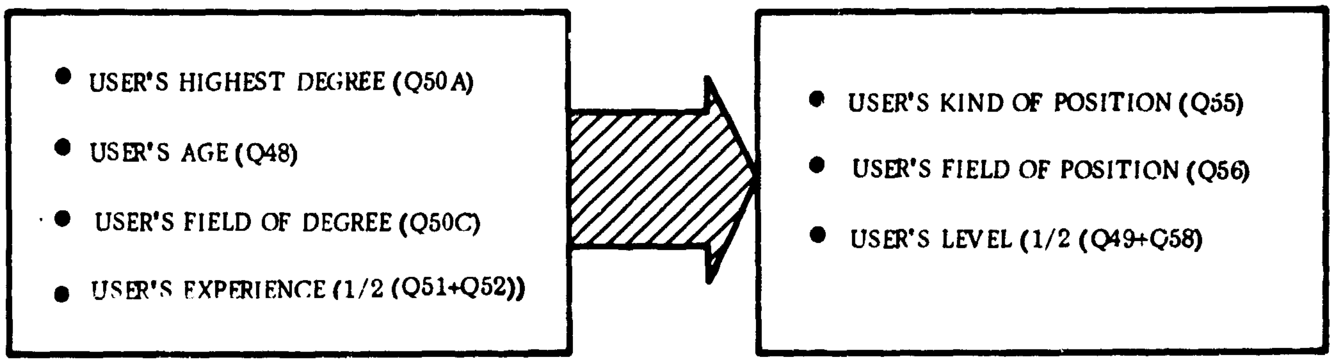
Combination of Questions \ Related Question Combinations	User's Age (Q48)	User's Highest Degree (Q50A)	User's Field of Degree (Q50C)	User's Experience (1/2 (Q51 + Q52))	User's Kind of Position (Q55)	User's Field of Position (Q56)	User's Level (1/2 (Q49 + Q58))	Use of Company TIC (Q33 · Q35)	Use of Specialized Information Centers (1/2 (Q40 + Q41))	Use of Specialized Information Services (1/2 (Q38 + Q44))	Use of TAB (Q37)	Use of DDC (Q39)	Use of TAB and DDC (1/2 (Q37 + Q39))	Restrictions (Q12 · Q43)	Difficulties (Q45 · Q46)	Utilization Effort (QE = 1/4 (Q33 · Q35) + 1/2 (Q40 + Q41) + 1/2 (Q38 + Q44) + 1/2 (Q37 + Q39))	Utilization Problems (QP = 1/2 (Q42 · Q43 + Q45 · Q46))
Use of Company TIC (Q33 · Q35)		2			1			0									
Use of Specialized Information Centers (1/2 (Q40 + Q41))		2			3		1	4	0								
Use of Specialized Information Services (1/2 (Q38 + Q44))		2			1		3	4	5	0							
Use of TAB (Q37)					4			3	2	1							
Use of DDC (Q39)					2		5	4	1	3			0				
Restrictions (Q42 · Q43)							2						1	0			
Difficulties (Q54 · Q46)		2							1					3	0		
Utilization Effort (QE = 1/4 (Q33 · Q35) + 1/2 (Q40 + Q41) + 1/2 (Q38 + Q44) + 1/2 (Q37 + Q39))		2			1		3									0	
Utilization Problems (QP = 1/2 (Q42 · Q43 + Q45 · Q46))		1			2		3									4	0
Question Combination Column Total	108	47	108	108	38	108	53	63	57	76	--	--	85	87	96	88	96
Question Combination Rank	13-1/2	2	13-1/2	13-1/2	1	13-1/2	3	5	4	6	--	--	7	8	10-1/2	9	10-1/2

*Table entries are assigned, according to order of appearance in Table 6-3, as follows: 0 to combination of questions in CHARACTERISTIC column; 1 to 1st question combination, 2 to 2nd question combination, . . . , m to last question combination in RELATED TO column; m+1 to 1st question combination, m+2 to 2nd question combination, . . . , p ≤ 11 to last question combination in CANDIDATE FOR RELATIONSHIP column; and 12, which is omitted for simplicity, to those question combinations not appearing. If a question occurs both alone and in a question combination, it is associated with the appropriate question combination which contains it. This applies to questions 37 and 39 in this table.

Table 6-9. SEARCH and ACQUISITION and Flow Process Ranks*

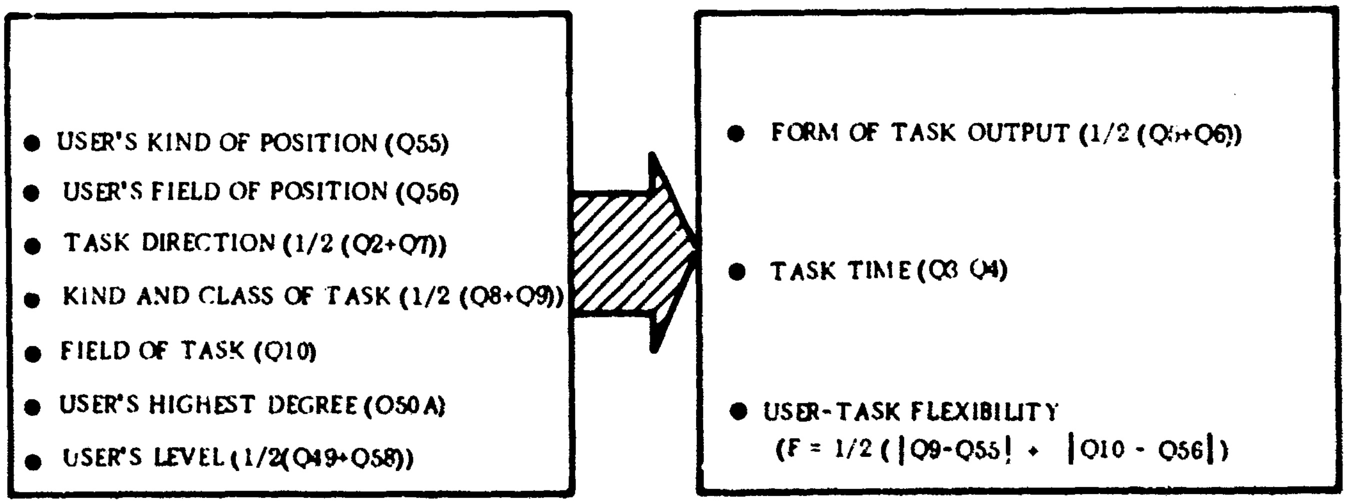
Combination of Questions \ Related Question Combinations	User's Age (Q44)	User's Highest Degree (Q50A)	User's Field of Degree (Q50C)	User's Experience (1/2 (Q51 + Q52))	User's Kind of Position (Q55)	User's Field of Position (Q56)	User's Level (1/2 (Q48 + Q49))	Task Direction (1/2 (Q2 + Q7))	Kind and Class of Task (1/2 (Q4 + Q9))	Field of Task (Q10)	Form of Task Output (1/2 (Q5 + Q6))	Task Time (Q3 · Q4)	User-Task Flexibility (F = 1/2 (Q9 - Q55) + (Q10 - Q56))	Use of Company TIC (Q35 · Q35)	Use of Specialized Information Centers (1/2 (Q40 + Q41))	Use of Specialized Information Services (1/2 (Q38 + Q41))	Use of TAB (Q37)	Use of DDC (Q39)	Use of TAB and DDC (1/2 (Q37 + Q39))	Utilization Restrictions (Q42 · Q43)	Utilization Difficulties (Q45 · Q47)	Utilization Effort (E = 1/4 (Q33 · Q35) + 1/2 (Q40 + Q41) + 1/2 (Q38 + Q44) + 1/2 (Q37 + Q39))	Utilization Problems (P = 1/2 (Q42 Q43 + Q45 Q46))	Desired Class of Information (Q16)	Class of Information (Q28)	Field of Information (Q29)	Desired Content of Information Media (1/2 (Q22 + Q25))	Actual Content of Information Media (1/2 (Q21 + Q24))	Desired Form of Information Media (1/2 (Q20 + Q27))	Actual Form of Information Media (1/2 (Q18 + Q26))	Location of First Source for Information (Q14)	Acquisition from First Source for Information (Q17)	Location & Acquisition from First Source for Information (1/2 (Q14 + Q17))	Why Used First Source for Information (Q15)	Location of and Why Used First Source, etc. (1/2 (Q14 + Q15))	Desired Acquisition Time (Q13)	Actual Acquisition Time (Q12)	Contribution of Information to Task (1/2 (Q30 + Q31))	Usefulness of Title Listings or Abstracts (Q23)	Discovery of Post Task Information (Q32)	Inadequacy of Search and Acquisition Process (I = 1/6 (|Q16 - Q28| + |1/2 (Q22 + Q25) - 1/2 (Q21 + Q24)| + |1/2 (Q20 + Q27) - 1/2 (Q18 + Q26)| + (1 - Q17) + |Q13 - Q12| + Q32))
Desired Class of Information (Q16)							2		1	3	4													0																	
Class of Information (Q28)						4			1		3													2	0										5						
Field of Information (Q29)									4	1	3													2	5	0															
Desired Content of Information Media (1/2 (Q22 + Q25))							3		4		5	1										2					0														
Actual Content of Information Media (1/2 (Q21 + Q24))																						2					1		2				4								
Desired Form of Information Media (1/2 (Q20 + Q27))					4							3										2					1		0												
Actual Form of Information Media (1/2 (Q18 + Q26))											7	4										3		5				2	1	0			4								
Location of First Source for Information (Q14)					6			4														5			7		3		2				0		0						
Acquisition from First Source for Information (Q17)												4											3				2		1				0								
Desired Acquisition Time (Q13)					5		2	9				1										8	10	6			3		4						7	0					
Actual Acquisition Time (Q12)							3			6		1										5	9	10				1		2					8	7	0				
Contribution of Information to Task (1/2 (Q30 + Q31))																								4	3			1		2					3			0			
Usefulness of Title Listings or Abstracts (Q23)								8	4		6											2		7			3		1						5				0		
Discovery of Post Task Information (Q32)									2													3	1				4		5											0	
Inadequacy of Search and Acquisition Process (I = 1/6 (|Q16 - Q28| + |1/2 (Q22 + Q25) - 1/2 (Q21 + Q24)| + |1/2 (Q20 + Q27) - 1/2 (Q18 + Q26)| + (1 - Q17) + |Q13 - Q12| + Q32))									3			1										4	2												6			5			0
Question Combination Column Total	160	160	160	160	159	172	142	165	115	154	136	111	160	160	160	160	--	--	160	160	160	96	145	120	156	168	101	139	101	148	----	----	142	----	130	163	168	161	168	168	168
Question Combination Rank	31	31	31	31	16	25	10-1/2	19	5	14	9	4	31	31	31	31	--	--	31	31	31	1	12	6	15	22	2-1/2	9	2-1/2	13	----	----	10-1/2	----	7	19	22	17	22	22	22
Flow Process Column Total (Aggregate)	392	291	409	410	289	373	316	387	344	384	376	351	420	387	381	400	--	--	409	411	420	326	385	372	404	420	353	391	353	400	----	----	394	----	382	413	420	413	420	420	420
Flow Process Rank (Aggregate)	19	2	24-1/2	26	1	10	3	16-1/2	5	14	11	6	33	16-1/2	12	21-1/2	--	--	24-1/2	27	33	4	15	9	23	33	7-1/2	18	7-1/2	21-1/2	----	----	20	----	13	29	33	[illegible]	33	33	33

*Table entries are assigned, according to order of appearance in Table 6-4, as follows: 0 to combination of questions in CHARACTERISTIC column; 1 to 1st question combination, 2 to 2nd question combination, ..., m to last question combination in RELATED TO column; m+1 to 1st question combination, m+2 to 2nd question combination, ..., p ≤ 11 to last question combination in CANDIDATE FOR RELATIONSHIP column; and 12, which is omitted for simplicity, to those question combinations not appearing. If a question occurs both alone and as a question combination, it is associated with the appropriate question combination which contains it. This applies to questions 14, 15, 17, 37 and 39.



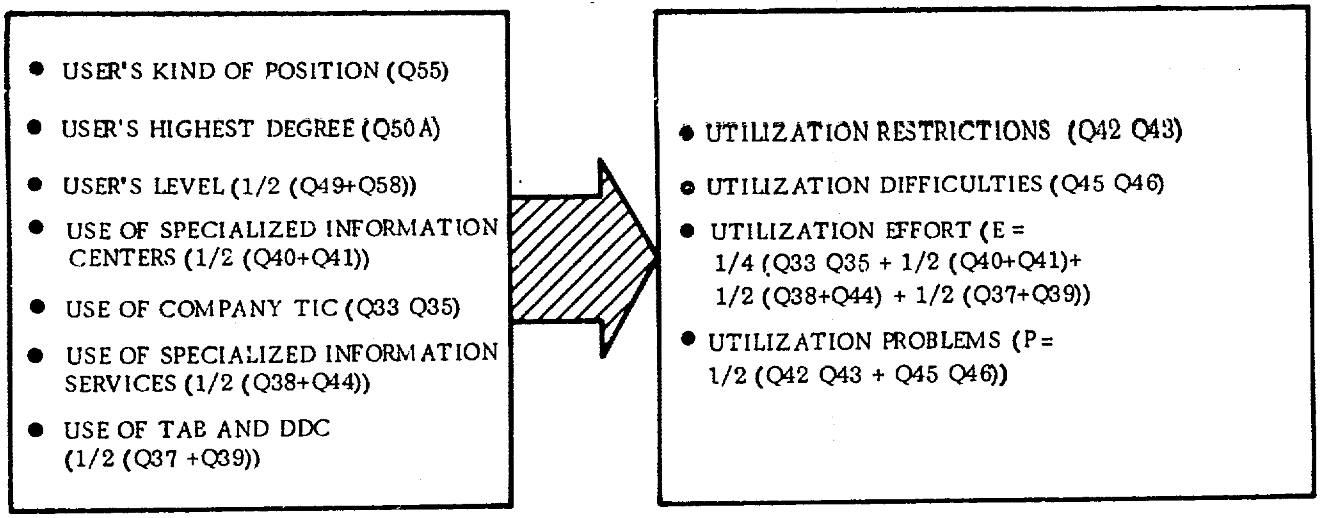
*Input factors listed in order of rank (see Table 6-6).

Figure 6-2. USER Input and Output Factors*



*Input factors listed in order of rank (see Table 6-7).

Figure 6-3. TASK Input and Output Factors*

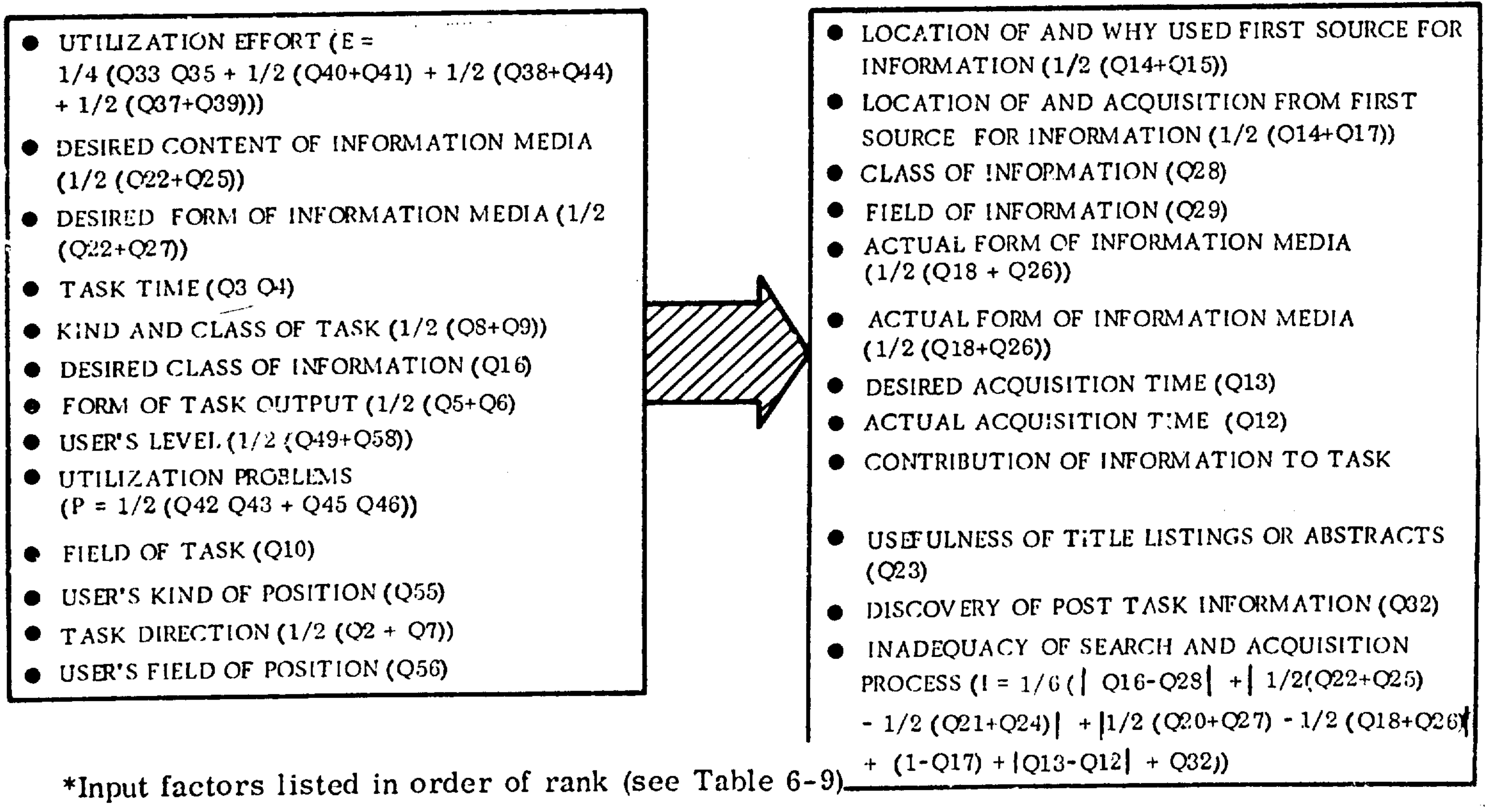


- USER'S KIND OF POSITION (Q55)
- USER'S HIGHEST DEGREE (Q50A)
- USER'S LEVEL (1/2 (Q49+Q58))
- USE OF SPECIALIZED INFORMATION CENTERS (1/2 (Q40+Q41))
- USE OF COMPANY TIC (Q33 Q35)
- USE OF SPECIALIZED INFORMATION SERVICES (1/2 (Q38+Q44))
- USE OF TAB AND DDC (1/2 (Q37 +Q39))

- UTILIZATION RESTRICTIONS (Q42 Q43)
- UTILIZATION DIFFICULTIES (Q45 Q46)
- UTILIZATION EFFORT (E = 1/4 (Q33 Q35 + 1/2 (Q40+Q41)+ 1/2 (Q38+Q44) + 1/2 (Q37+Q39))
- UTILIZATION PROBLEMS (P = 1/2 (Q42 Q43 + Q45 Q46))

*Input factors listed in order of rank (see Table 6-8).

Figure 6-4. UTILIZATION Input and Output Factors*

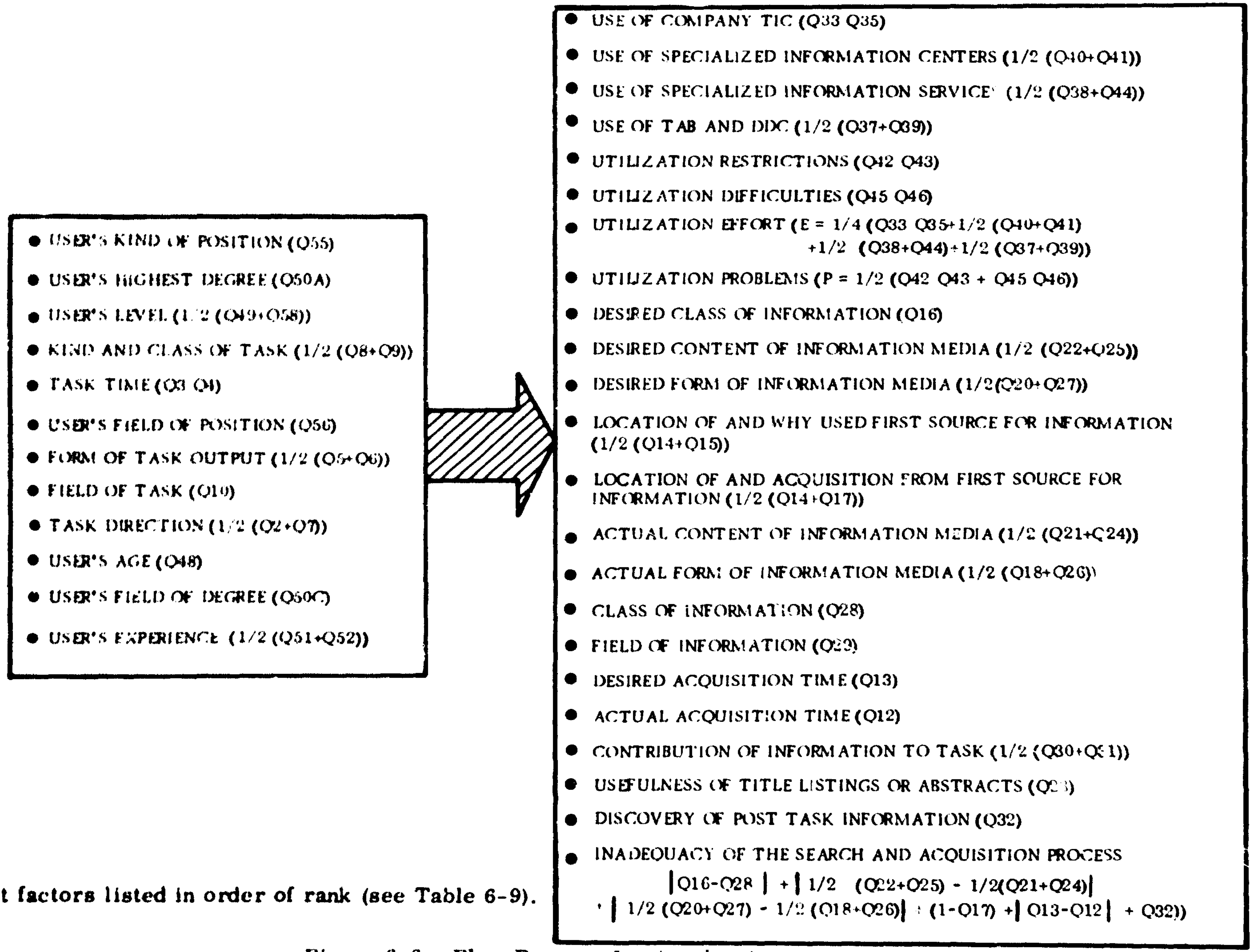


- UTILIZATION EFFORT (E = 1/4 (Q33 Q35 + 1/2 (Q40+Q41) + 1/2 (Q38+Q44) + 1/2 (Q37+Q39)))
- DESIRED CONTENT OF INFORMATION MEDIA (1/2 (Q22+Q25))
- DESIRED FORM OF INFORMATION MEDIA (1/2 (Q22+Q27))
- TASK TIME (Q3 Q4)
- KIND AND CLASS OF TASK (1/2 (Q8+Q9))
- DESIRED CLASS OF INFORMATION (Q16)
- FORM OF TASK OUTPUT (1/2 (Q5+Q6)
- USER'S LEVEL (1/2 (Q49+Q58))
- UTILIZATION PROBLEMS (P = 1/2 (Q42 Q43 + Q45 Q46))
- FIELD OF TASK (Q10)
- USER'S KIND OF POSITION (Q55)
- TASK DIRECTION (1/2 (Q2 + Q7))
- USER'S FIELD OF POSITION (Q56)

- LOCATION OF AND WHY USED FIRST SOURCE FOR INFORMATION (1/2 (Q14+Q15))
- LOCATION OF AND ACQUISITION FROM FIRST SOURCE FOR INFORMATION (1/2 (Q14+Q17))
- CLASS OF INFORMATION (Q28)
- FIELD OF INFORMATION (Q29)
- ACTUAL FORM OF INFORMATION MEDIA (1/2 (Q18 + Q26))
- ACTUAL FORM OF INFORMATION MEDIA (1/2 (Q18+Q26))
- DESIRED ACQUISITION TIME (Q13)
- ACTUAL ACQUISITION TIME (Q12)
- CONTRIBUTION OF INFORMATION TO TASK
- USEFULNESS OF TITLE LISTINGS OR ABSTRACTS (Q23)
- DISCOVERY OF POST TASK INFORMATION (Q32)
- INADEQUACY OF SEARCH AND ACQUISITION PROCESS (I = 1/6 (| Q16-Q28| + | 1/2(Q22+Q25) - 1/2 (Q21+Q24)| + |1/2 (Q20+Q27) - 1/2 (Q18+Q26)| + (1-Q17) + |Q13-Q12| + Q32))

*Input factors listed in order of rank (see Table 6-9).

Figure 6-5. SEARCH and ACQUISITION Input and Output Factors*



- USER'S KIND OF POSITION (Q55)
- USER'S HIGHEST DEGREE (Q50A)
- USER'S LEVEL (1/2 (Q49+Q58))
- KIND AND CLASS OF TASK (1/2 (Q8+Q9))
- TASK TIME (Q3 Q4)
- USER'S FIELD OF POSITION (Q56)
- FORM OF TASK OUTPUT (1/2 (Q5+Q6))
- FIELD OF TASK (Q10)
- TASK DIRECTION (1/2 (Q2+Q7))
- USER'S AGE (Q48)
- USER'S FIELD OF DEGREE (Q50C)
- USER'S EXPERIENCE (1/2 (Q51+Q52))

- USE OF COMPANY TIC (Q33 Q35)
- USE OF SPECIALIZED INFORMATION CENTERS (1/2 (Q40+Q41))
- USE OF SPECIALIZED INFORMATION SERVICES (1/2 (Q38+Q44))
- USE OF TAB AND DDC (1/2 (Q37+Q39))
- UTILIZATION RESTRICTIONS (Q42 Q43)
- UTILIZATION DIFFICULTIES (Q45 Q46)
- UTILIZATION EFFORT (E = 1/4 (Q33 Q35+1/2 (Q40+Q41) +1/2 (Q38+Q44)+1/2 (Q37+Q39))
- UTILIZATION PROBLEMS (P = 1/2 (Q42 Q43 + Q45 Q46))
- DESIRED CLASS OF INFORMATION (Q16)
- DESIRED CONTENT OF INFORMATION MEDIA (1/2 (Q22+Q25))
- DESIRED FORM OF INFORMATION MEDIA (1/2(Q20+Q27))
- LOCATION OF AND WHY USED FIRST SOURCE FOR INFORMATION (1/2 (Q14+Q15))
- LOCATION OF AND ACQUISITION FROM FIRST SOURCE FOR INFORMATION (1/2 (Q14+Q17))
- ACTUAL CONTENT OF INFORMATION MEDIA (1/2 (Q21+Q24))
- ACTUAL FORM OF INFORMATION MEDIA (1/2 (Q18+Q26))
- CLASS OF INFORMATION (Q28)
- FIELD OF INFORMATION (Q29)
- DESIRED ACQUISITION TIME (Q13)
- ACTUAL ACQUISITION TIME (Q12)
- CONTRIBUTION OF INFORMATION TO TASK (1/2 (Q30+Q31))
- USEFULNESS OF TITLE LISTINGS OR ABSTRACTS (Q23)
- DISCOVERY OF POST TASK INFORMATION (Q32)
- INADEQUACY OF THE SEARCH AND ACQUISITION PROCESS
  |Q16-Q28| + |1/2 (Q22+Q25) - 1/2(Q21+Q24)|
  + |1/2 (Q20+Q27) - 1/2 (Q18+Q26)| + (1-Q17) + |Q13-Q12| + Q32))

Figure 6-6. Flow Process Input and Output Factors*

*Input factors listed in order of rank (see Table 6-9).

7. COMPARISON OF PHASES I AND II

The Department of Defense (DOD) User-Needs Studies on the flow of scientific and technical information were originated to establish an understanding of the scientific and engineering process and its information needs. The first study, Phase I[1], concentrated on determining the user-needs of research, development, testing, and evaluation (RDT&E) personnel within DOD. The current study, Phase II, was initiated on the assumption that the description of the DOD scientific and engineering process and its information needs did not necessarily depict the situation as it exists in the defense industry – the largest generator and user of DOD sponsored information. The development of an understanding of these two users of scientific and technical information, their differences, and their combination into a picture of the scientific and engineering process and its information needs, would give the first comprehensive definition of information requirements in today's complex array of scientific and engineering endeavors.

This section will present the differences and similarities between the two samples. The Phase I and Phase II data were compared for three sets of study results:

- The one-way frequency distributions.
- The two-way frequency distributions.
- A review of the Phase I conclusions.

7.1 ONE-WAY FREQUENCY DISTRIBUTIONS

One question posed for this analysis is "How, if at all, do the Phase I sample (DOD RDT&E personnel) and the Phase II sample (defense industry scientific and technical personnel) differ from each other?" In analyzing the one-way frequency distributions to answer this question, two approaches have been used:

- An enumeration of the specific or unique characteristics of the one-way frequency distributions which were cited in the Phase I Final Report, and the corresponding information for Phase II.
- A statistical comparison of the corresponding Phase I and Phase II one-way frequency distributions.

Sample Characteristics

Table 7-1 presents a summary comparison of sample characteristics for Phases I and II. A visual check of the two sets of data reveals that, of the 39 characteristics presented:

- Fifteen, of the 28 items having percentages as descriptors, differ by more than 5 percentage points (with 11 of these differences being equal to or greater than 10 points).
- Eight, of the eleven items that use category designators as descriptors, are different.

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[1] The results of Phase I, which interviewed 1375 of the approximately 36, 000 DOD personnel in RDT&E, are presented in Reference 1.

Table 7-1. Summary Comparison of Phase I and Phase II

Characteristics	Phase I(DOD RDT&E)	Phase II(Defense Industry)
USER		
a. Engineering degree	51 percent	56 percent
b. At least a bachelor's degree	90 percent	85 percent
c. Advanced degree	25 percent	32 percent
d. MOS in engineering	50 percent	64 percent
e. MOS in physical science	25 percent	12 percent
f. Modal (equivalent) GS rating	GS-13	GS-14
g. Median age	40 years	38 years
h. Modal type position	Scientific and engineering	Scientific and engineering
i. Development position	40 percent	40 percent
TASK		
a. Modal task duration	Less than 1 week	Over 1 month
b. Tasks of longer duration	Research	Research
c. Development tasks	41 percent	38 percent
d. Modal task output	Finding	Recommendation
e. Written task output	71 percent	89 percent
f. Formal task output	60 percent	71 percent
g. Modal field of task	Research and research equipment	Electronics
h. Modal kind of task	R&D support	Applied research
UTILIZATION		
a. Use of DOD Center		
(1) DDC	47 percent	45 percent
(2) TAB	43 percent	35 percent
(3) Specialized Information Centers	55 percent	44 percent

Table 7-1. (Cont)

Characteristics	Phase I(DOD RDT&E)	Phase II(Defense Industry)
UTILIZATION (Cont)		
b. Unaware of existence of:		
(1) DDC	21 percent	32 percent
(2) TAB	40 percent	43 percent
(3) DOD and other Specialized Information Centers	19 percent	37 percent
c. Difficulties with information acquisition and use	27 percent	42 percent
SEARCH AND ACQUISITION		
a. Mean actual acquisition time	Less than 1 day	1 day to 1 week
b. Desired information in less than 1 day	21 percent	23 percent
c. Actually received information in less than 1 day	49 percent	40 percent
d. First source for information		
(1) Mode	Colleague	Colleague
(2) Local work environment	60 percent	51 percent
(3) External to local work environment	12 percent	20 percent
(4) No search required	29 percent	30 percent
(5) Use of libraries	5 percent	10 percent
(6) Use of DOD information systems	0.04 percent	1.30 percent
e. Reliance on recall	17 percent	7 percent
f. Actually received all available information	16 percent	29 percent
g. Use of engineering information	42 percent	40 percent
h. Use of oral contact as information media	29 percent	26 percent

Table 7-1. (Cont)

Characteristics	Phase I(DOD RDT&E)	Phase II(Defense Industry)
SEARCH AND ACQUISITION (Cont)		
i. Most commonly used written information media	Reports	Reports
j. Information that was not absolutely essential to the task	Have no unique or significant characteristics	Have unique and significant characteristics

- Two, of the percentage differences that are 5 percent or under, still show a marked sample difference; e.g., the difference in use of DOD information systems as a first source for information (0.04 percent vs. 1.30 percent), and use of libraries as a first source for information (5 percent vs. 10 percent). These observations lead to a conjecture of differences between the two samples, with the differences distributed throughout all four components or profiles (USER, TASK, UTILIZATION, AND SEARCH AND ACQUISITION). The differences between the individual responses presented in Table 7-1 will be explained below.

The last item in Table 7-1, information that was not absolutely essential to the task, involves comparisons using pairs of questions. However, it will be covered here, since it was covered in the discussion of Phase I one-way frequency distributions and has no two-way frequency distributions in the Phase I Final Report. Concerning information which was not absolutely essential to the task, the Phase I Final Report says: "Those information chunks that the task could have been completed without did not display unique or significant characteristics." During the Phase II analysis, the essentiality of information to the task was investigated via six other questions: actual depth of information media (Q21), actual volume of information media (Q24), actual composition of information media (Q18), class of information (Q28), field of information (Q29), and extensiveness of information use in task (Q31). A statistical comparison was run for each of these questions, comparing the answers corresponding to absolutely essential information and those corresponding to not absolutely essential information for each item within the questions. The summarized results are presented in Table 7-2. In each case there is a significant difference between the two samples. The actual volume and depth of the less essential information was not large. The information media in which it was found were the most formal type of composition (i.e., journal articles, textbooks, and reports). A low proportion of the less essential information was engineering data (i.e., specifications, design, and performance and characteristics information), and a much smaller proportion of the information fell in the aeronautics and space technology field. The essentiality of the information to the task and extensiveness of its use in the task are positively correlated ($r = 0.46$), as could be expected.

Table 7-2. Effect of Essentiality of Information on Selected Questions*

Question	Description	χ^2	df	α	Remarks**
21	Actual Volume of Information Media	127.16	3	$\alpha < 0.0005$	High proportion: sampling (24.92). Low proportion: all material available (38.40).
24	Actual Depth of Information Media	315.32	2	$\alpha < 0.0005$	High proportion: once over lightly (119.13). Low proportion: detailed analysis (25.99), and specific answer (12.55).
18	Actual Composition of Information Media	338.86	26	$\alpha < 0.0005$	High proportion: journals (29.85), preprints and reprints (13.89), textbooks (12.93) and reports (8.10). Low proportion: drawings and schematics (41.01), system specification documents (24.27), directives (10.82), and manuals (9.61).
28	Class of Information	323.40	13	$\alpha < 0.0005$	High proportion: technical status (19.99), utilization (13.40) and experimental processes and procedures (12.95). Low proportion: specifications (23.79), design and design techniques (15.62), and performance and characteristics (13.34).
29	Field of Information	110.82	8	$\alpha < 0.0005$	High proportion: behavioral and social sciences (17.55), and mathematics (9.66). Low proportion: aeronautics and space technology (11.71).
31	Extensiveness of Information Use	1881.26	5	$\alpha < 0.0005$	High proportion: as background information (268.89), in small part of the task (153.16), not at all (58.14), and as lead to other information (11.89). Low proportion: throughout entire task (442.36).

*The answers to each question were put into two groups, those corresponding to absolutely essential information and those corresponding to not absolutely essential information and the resulting one-way frequency distributions were compared.

**Numbers in ( ) are an item's contribution to $J^2 = 1/2\ \chi^2$.

Statistical Comparison

In selecting the one-way frequency distributions from Phase I and Phase II for the statistical analysis, it was found that 37 of the Phase II questions were comparable with those of Phase I. The questions which are not comparable with those of Phase I are presented in Table 7-3, with an explanation of the non-comparability. The non-comparable questions fall into four categories:

- Narrative questions which were not categorized in Phase II.
- Narrative questions which were not categorized in Phase I.
- Questions which were new in Phase II.
- Questions which have incompatible data.

Each comparable question was subjected to a statistical analysis, to test the hypothesis that the samples came from the same populations. The hypothesis was rejected, with $\alpha < 0.0005$, for 41 of the 44 comparisons made (some questions were compared in two different ways). Section 4 describes the analysis. A summary of it is presented in Table 7-4 and its tables are presented in Volume III.

There were three areas where the Defense Industry and DOD RDT&E samples showed no significant differences. These were:

- The percentage of time on task (Q4).
- The essentiality of information (Q31).
- The interviewer assessment of information needs of user (Q59).

The survey questions which revealed the greatest differences between the two samples were in SEARCH AND ACQUISITION, although significant variations were also found in USER, TASK, and UTILIZATION. The most prominent differences in each component were:

USER (See Figure 7-1)

- Number of years in the kind of work activity.
- The type of work activity.

TASK (See Figure 7-2)

- Task recipient.
- Task initiator.
- Formality of task outputs.

UTILIZATION (See Figure 7-3)

- Encounter of difficulties.

Table 7-3. Phase II Questions Not Comparable with Phase I Questions

Phase II Question	Phase I Question	Description	Reason
1	12	Description of Task	Narrative - not categorized
3	17	Task Duration	Given as task duration divided by percentage of time on task in Phase I.
11	24	Description of Information	Narrative - not categorized
16	44	Desired Class of Information	Narrative - not categorized in Phase I.
17	45	Acquisition from First Source for Information	Phase I data has 785 blanks, which are related to recall.
20	31	Desired Composition of Information Media	Phase II data organized differently than Phase I data.
23	34	Usefulness of Title Listings or Abstracts	In Phase I, the question was about only 19 percent of the information chunks, those which required a lot of material.
26	40	Actual Layout of Information Media	66 percent of Phase I data is in the other combinations, other, or blank categories.
27	41	Desired Layout of Information Media	63 percent of Phase I data is in the other combinations or blank categories.
33	-	Existence of Company TIC	New question in Phase II.
34	-	Known Company TIC Services	New question in Phase II.
35	-	Use of Company TIC	New question in Phase II.
36	-	Evaluation of Company TIC	New question in Phase II.
38	-	Use of STAR	New question in Phase II.
41	-	Use of Other Specialized Information Centers	New question in Phase II.
42	-	Encounter of Restrictions	New question in Phase II.
43	-	Nature of Restrictions	New question in Phase II.
46	57	Nature of Difficulties	Narrative - not categorized in Phase I.
47	58	Solutions for Difficulties	Narrative - not categorized in Phase I.
52	-	User's Company Experience	New question in Phase II.

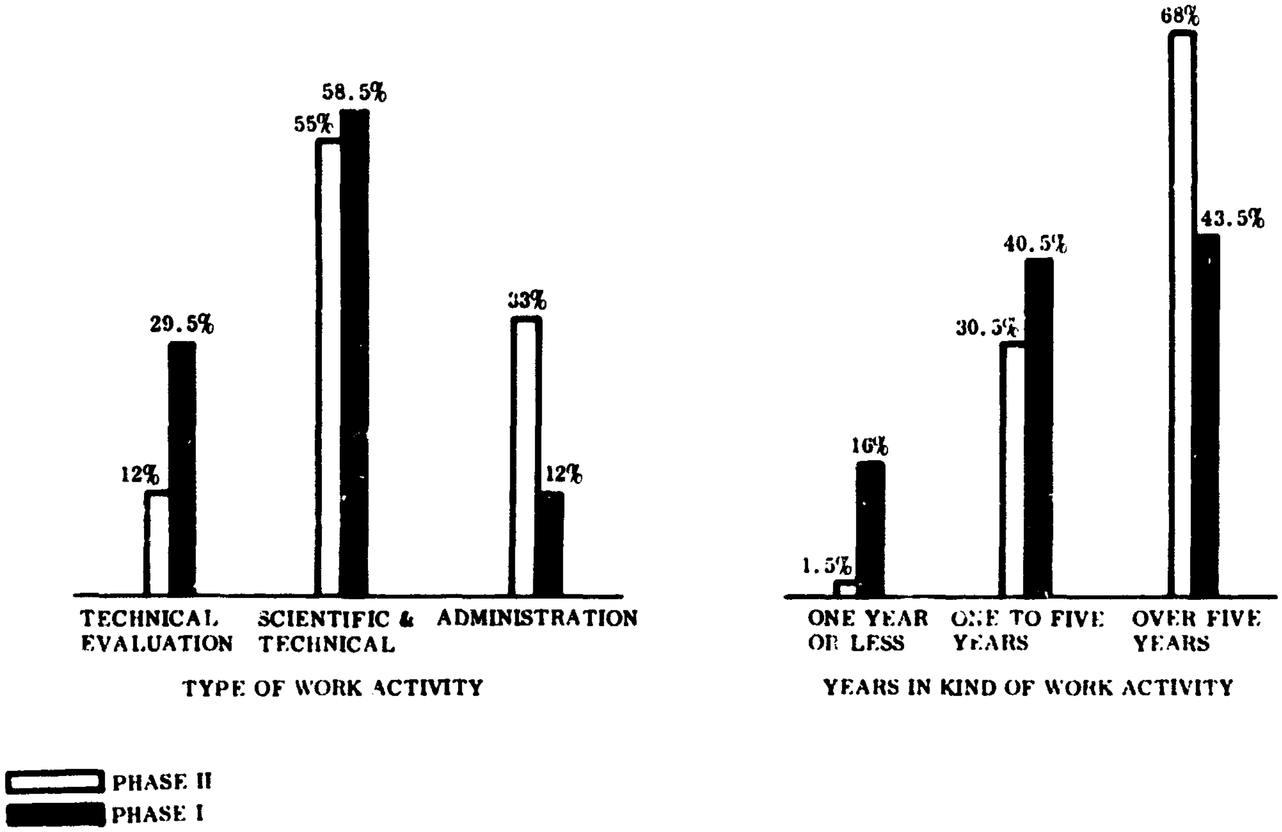


Figure 7-1. Comparison of Phases I and II - USER

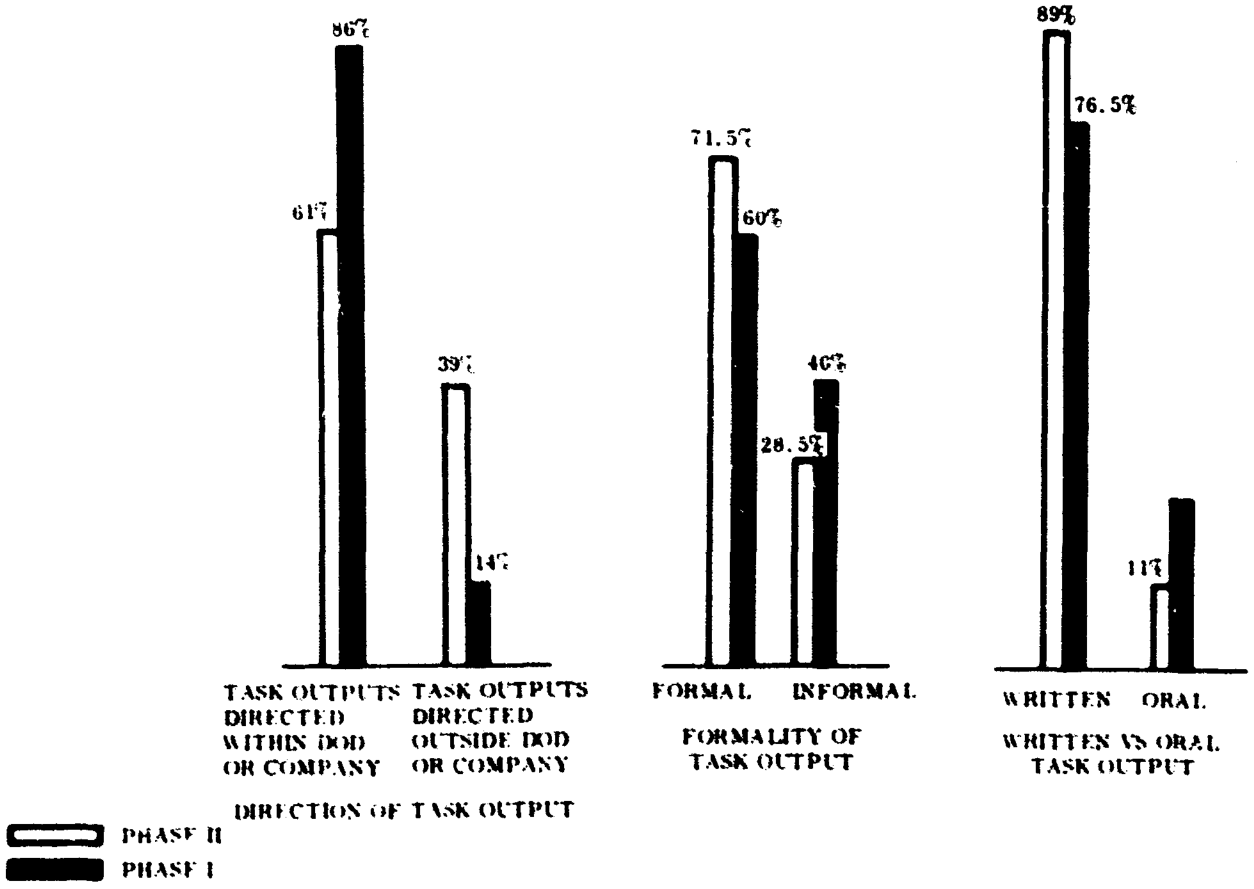


Figure 7-2. Comparison of Phases I and II - TASK

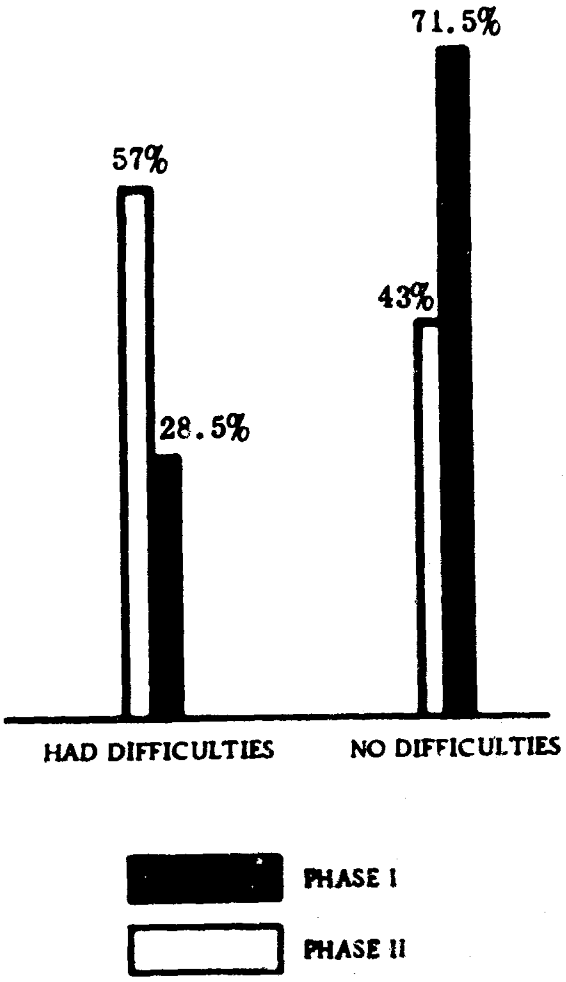


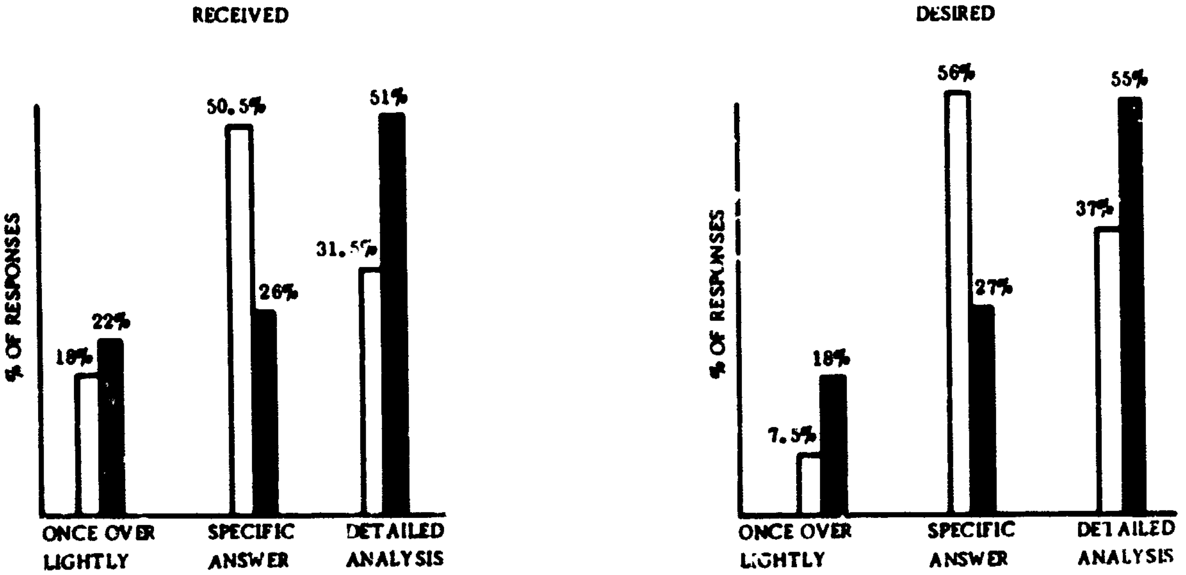
Figure 7-3. Comparison of Phases I and II - Utilization Difficulties

SEARCH AND ACQUISITION (See Figure 7-4)

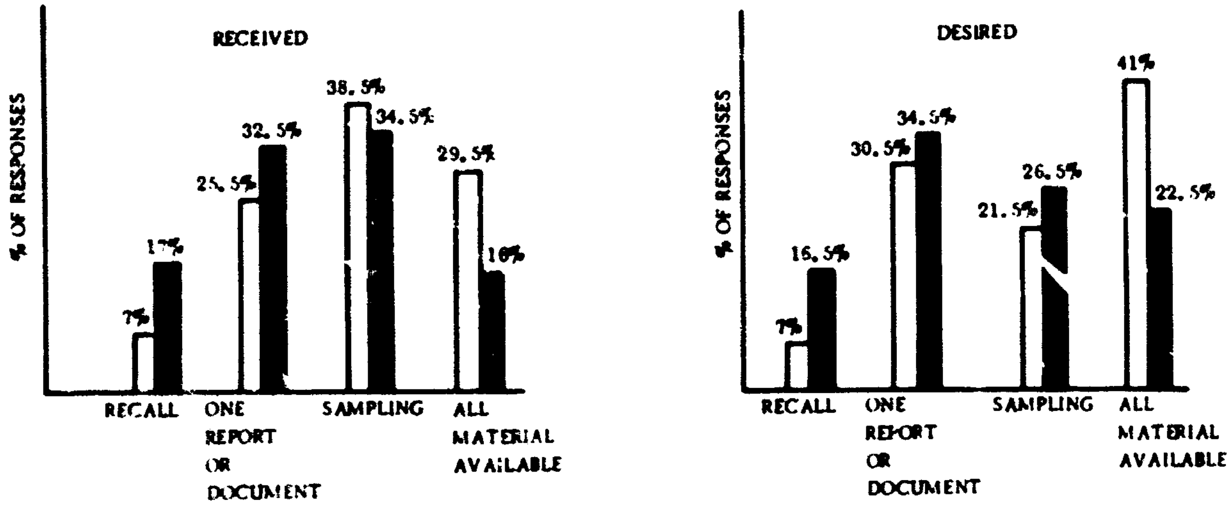
- Depth of information media.
- Volume of information media.
- Acquisition time.
- Field of information.

Differences between the two samples may be summarized as follows:

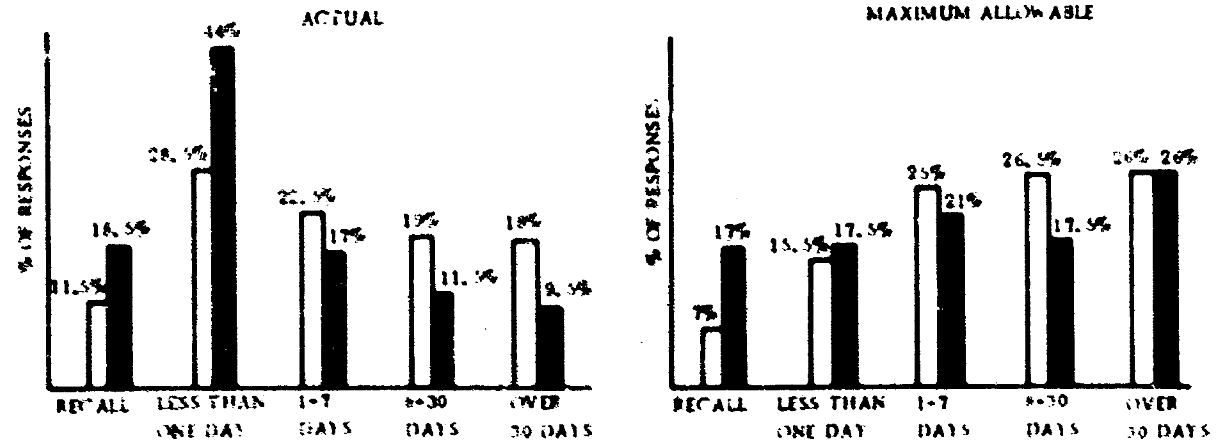
- The personnel in the defense industry sample tend to be younger, have more post-graduate degrees, have been in their present job longer, are more involved in technical management and administration, and are higher paid than the DOD RDT&E sample. They are more involved in engineering development work and less involved in operational system development than the DOD personnel.



DEPTH OF INFORMATION MEDIA



VOLUME OF INFORMATION MEDIA



ACQUISITION TIME

■ PHASE I ☐ PHASE II

Figure 7-4. Comparison of Phases I and II - SEARCH AND ACQUISITION

- There are fewer self-generated tasks, more formal task outputs, and more external recipients of task outputs within the defense industry sample. The defense industry tasks deal more with concepts, design, production, research, aeronautics and space technology, electronics and electrical engineering, and propulsion systems than do those of the DOD sample. The converse is true of test processes and procedures, cost, funding, and administrative action, operational development, ordnance, medical science, and communication tasks.

- While using DDC, TAB, and Specialized Information Centers about as much as the DOD sample, the defense industry sample was unaware of DDC more often. However, a greater percentage of those who knew of the services, used them. Also the defense industry sample reported that it found post task information more often than did the DOD sample.

- The members of the defense industry sample had less of a time constraint, both in task duration and acquisition time, as they could and did take longer to gather their information. They were less dependent upon the local work environment as a first source for task information; used a first source more because it was available or the only source known, and less because they were told or recalled that the information was available from the source; and actually received less information with the task assignment than the DOD RDT&E sample. The defense industry sample desired and actually received all the material available, and a specific answer more often; while relying on recall and one report or document less, and desiring and actually receiving less information in the form of once-over-lightly or detailed analysis presentations. They also used their information more directly in the task and less as background information.

Table 7-4 presents the results and some comments concerning the comparison of the Phase I and Phase II one-way frequency distributions.

Table 7-4. Comparison of Phase I and Phase II One-Way Frequency Distributions

Question		Description	χ^2	df	α	Difference	Area of Difference
Phase II	Phase I						
2	15 and 16	Task Initiator	246.58	2	$\alpha<0.0005$	Yes	Larger proportion of defense industry tasks are assigned.
4	18	Percentage of Time	14.38	4	$0.005<\alpha<0.01$	No	
5	20	Type of Task Output	16.00	2	$\alpha<0.0005$	Yes	Defense industry makes more recommendations and has less findings, while making decisions are about as much.
6A	21	Formality of Task Output - Written or Oral	86.88	1	$\alpha<0.0005$	Yes	DOD RDT&E personnel use more oral presentations.
6B	22	Formality of Task Output - Formal or Informal	42.78	1	$\alpha<0.0005$	Yes	DOD RDT&E personnel use more informal presentations.
7	23	Task Recipient	242.32	1	$\alpha<0.0005$	Yes	Defense industry's outputs are more externally oriented.
8	94	Class of Task	200.22	11	$\alpha<0.0005$	Yes	DOD tasks are heavier in the area of administrative action, costs and funding, and evaluation; while defense industry tasks are heavier in production, concepts, and design.
9	14	Kind of Task	50.80	5	$\alpha<0.0005$	Yes	Defense industry tasks are higher in research; and DOD RDT&E tasks are higher in operational development.

Table 7-4. (Cont)

Question		Description	χ^2	df	α	Difference	Area of Difference
Phase II	Phase I						
10A	12	Field of Task - Grouped	143.56	8	$\alpha < 0.0005$	Yes	Defense industry tasks are higher in aeronautics and space technology, and behavioral and social sciences; and DOD tasks are higher in medical sciences and research (including computer science).
10B	12	Field of Task - Ungrouped	429.42	33	$\alpha < 0.0005$	Yes	Defense industry tasks are higher in production and management, aircraft and flight equipment, electronics and propulsion systems; DOD tasks are higher in medical sciences and research (including computer science).
12	35	Actual Acquisition Time	541.32	4	$\alpha < 0.0005$	Yes	Information reported to be acquired faster by DOD RDT&E personnel.
13	36	Desired Acquisition Time	340.92	4	$\alpha < 0.0005$	Yes	Information desired (needed) in shorter time by DOD RDT&E personnel.
14	42	Location of First Source for Information	368.16	10	$\alpha < 0.0005$	Yes	Defense industry is higher in the use of library facilities, external consultants and DOD information systems; and DOD is higher in the use of one's own collection and departmental files.
15	43	Why Used First Source for Information	224.86	5	$\alpha < 0.0005$	Yes	Defense industry is higher in availability, and only source known; and DOD is higher in received with task assignment, and recalled or told of source.

Table 7-4. (Cont)

Question		Description	χ^2	df	α	Difference	Area of Difference
Phase II	Phase I						
18	28	Actual Composition of Information Media	579.14	24	$\alpha < 0.0005$	Yes	Defense industry is higher in the use of previous knowledge, drawings and schematics, correspondence, meetings and symposia, system specifications, and preprints and reprints; and DOD is higher in the use of standards and codes, and reports.
19	29	Usual Composition of Information Media	70.58	1	$\alpha < 0.0005$	Yes	DOD RDT&E personnel reported a proportionately higher incidence of non-regularly used media.
21	32	Actual Volume of Information Media	484.98	3	$\alpha < 0.0005$	Yes	Defense industry is higher in the use of all material available, and DOD is higher in the use of recall.
22	33	Desired Volume of Information Media	553.84	3	$\alpha < 0.0005$	Yes	Defense industry is higher in the desire for all material available, and DOD is higher in the desire for recall.
24	38	Actual Depth of Information Media	708.60	2	$\alpha < 0.0005$	Yes	Defense industry is higher in the actual receipt of a specific answer, and DOD is higher in the actual receipt of detailed analysis.
25	39	Desired Depth of Information Media	1024.82	2	$\alpha < 0.0005$	Yes	Defense industry is higher in the desire of a specific answer, and DOD is higher in the desire of once over lightly, and detailed analysis.

Table 7-4. (Cont)

Question		Description	χ^2	df	α	Difference	Area of Difference
Phase II	Phase I						
28	40	Class of Information	414.02	12	$\alpha < 0.0005$	Yes	Defense industry is higher in design, production, and raw data, and DOD is higher in technical status and utilization.
29A	26	Field of Information - Grouped	461.82	8	$\alpha < 0.0005$	Yes	Defense industry is higher in behavioral and social sciences, aeronautics and space technology, and physical science; and DOD is higher in research (including computer science), medical, and chemical sciences.
29B	26	Field of Information - Ungrouped	1097.02	33	$\alpha < 0.0005$	Yes	Defense industry is higher in production, aircraft and flight equipment, electronics, propulsion systems, installations and construction, fluid mechanics, and chemistry, and DOD is higher in ordnance, research (including computer science), communication, medical sciences, nuclear physics, detection, chemical warfare, photography, and ships and marine.
30	46	Essentiality of Information	11.96	1	$0.0005 < \alpha < 0.001$	No	
31	47	Extensiveness of Information Use	129.56	3	$\alpha < 0.0005$	Yes	DOD RDT&E personnel used a higher proportion of information as background information.

Table 7-4. (Cont)

Question		Description	χ^2	df	α	Difference	Area of Difference
Phase II	Phase I						
32	48	Discovery of Post Task Information	27.98	1	$\alpha < 0.0005$	Yes	DOD RDT&E personnel found proportionately less post task information.
37	49	Use of TAB	19.46	2	$\alpha < 0.0005$	Yes	More DOD RDT&E personnel see every issue of TAB.
39	50 and 51	Use of DDC	55.76	2	$\alpha < 0.0005$	Yes	Defense industry is higher in "do not know of DDC," and DOD RDT&E is higher in "know of, but do not use."
40	52 and 53	Use of DOD Specialized Information Centers	119.24	2	$\alpha < 0.0005$	Yes	Defense industry is higher in "do not know of DOD Specialized Information Centers," and DOD is higher in "know of, but do not use," and "use centers."
44	54	Use of English Abstracts or Translations	78.24	1	$\alpha < 0.0005$	Yes	DOD RDT&E personnel used more translations of foreign publications.
45	56	Encounter of Difficulties	252.58	2	$\alpha < 0.0005$	Yes	More difficulties reported by defense industry personnel.
48	2	User's Year of Birth/Age	61.66	8	$\alpha < 0.0005$	Yes	DOD RDT&E personnel are proportionately higher in the over 55 years old category. Defense industry personnel are higher in the 30-40 year old category.
49	3	Number of Personnel Supervised by User	53.6	5	$\alpha < 0.0005$	Yes	Defense industry personnel have a higher proportion of supervisors.

Table 7-4. (Cont)

Question		Description	χ^2	df	α	Difference	Area of Difference
Phase II	Phase I						
50A	4	User's Highest Degree	38.74	3	$\alpha < 0.0005$	Yes	Defense industry personnel have more advanced degrees.
50B	5	User's Year of Degree	20.18	2	$\alpha < 0.0005$	Yes	A greater proportion of the DOD RDT&E sample received their degrees before 1945.
50C	4	User's Field of Degree	75.10	7	$\alpha < 0.0005$	Yes	DOD RDT&E is higher in biology and chemistry, and defense industry is higher in engineering.
51	8	User's Job Experience	327.48	2	$\alpha < 0.0005$	Yes	DOD RDT&E personnel are higher in one year and under, and five years and over.
54	9	User's Type of Activity	265.70	2	$\alpha < 0.0005$	Yes	DOD RDT&E personnel are higher in technical evaluation, and lower in technical administration.
55	10	User's Kind of Position	59.92	5	$\alpha < 0.0005$	Yes	Defense industry is higher in engineering development, and DOD is higher in operational development.
56A	11	User's Field of Position - Grouped	157.86	8	$\alpha < 0.0005$	Yes	Defense industry is higher in behavioral and social sciences, and DOD is higher in medical sciences, chemical sciences and materials, and research (including computer science).

Table 7-4. (Cont)

Question		Description	χ^2	df	α	Difference	Area of Difference
Phase II	Phase I						
56B	11	User's Field of Position - Ungrouped	533.36	33	$\alpha < 0.0005$	Yes	Defense industry is higher in electronics, production, aircraft and flight equipment, and propulsion systems, and DOD is higher in ordnance, detection, medical sciences, communications, ships and marine equipment, and research (including computer science).
58	1	User's (Equivalent) GS Rating	240.26	7	$\alpha < 0.0005$	Yes	DOD RDT&E has a larger proportion of lower salaried personnel.
59	59	Interviewer Assessment of Information Needs of User	11.76	2	$0.001 < \alpha < 0.005$	No	

7.2 TWO-WAY FREQUENCY DISTRIBUTIONS

There are 46 two-way frequency distributions discussed in the Phase I Final Report (Reference 1). These two-way frequency distributions investigate the interaction of USER characteristics with TASK characteristics, class of information with TASK and other SEARCH AND ACQUISITION characteristics, first source for information with TASK and other SEARCH AND ACQUISITION characteristics, desired volume of information media with kind of task and actual depth of information media, desired depth of information media with kind of task and task duration, and actual acquisition time with kind of task and task duration.

Comparison of the Phase I conclusion for each two-way frequency distribution with the corresponding Phase II conclusion is presented in Table 7-5. The more prominent results of this comparison follow.

USER Characteristics

The USER characteristics investigated in Phase I were GS rating vs. type of work activity, and kind and field of the USER's position. The interactions established for the GS rating were that people in R&D support tasks were the highest level group, with research not showing a high proportion of upper level personnel. There was no interaction between GS level and the field of task, except for those in aircraft and flight equipment being slightly higher than the rest of the sample, and personnel whose activities are classified as detailed scientific and engineering were proportionally at lower levels than technical evaluation and administrative personnel. The GS rating of an individual had no interaction with the discovery of post task information, nor with the expression of problems in information acquisition or use; although the existence of problems was related to having advanced degrees (i. e., a larger proportion of individuals with advanced degrees reported the encounter of information problems). There was an interaction between GS level and use of the Defense Documentation Center and DOD Specialized Information Centers, which indicated that the higher the GS rating, the more apt the individual was to use these information systems.

The Phase II two-way distributions parallelled three of these findings: (1) there was no interaction between the discovery of post task information and salary or personnel level; (2) individuals with advanced degrees report more problems in the acquisition and use of information; and (3) the higher the GS rating or industrial equivalent, the more likely is the use of DDC or other Specialized Information Centers. Those interactions from Phase II which were different are: (1) personnel who are involved in research tasks are proportionally high in the higher salary levels, while R&E Support is nearly equally distributed according to the sample distribution; (2) aeronautics and space technology (which is dominated by aircraft and flight equipment) shows no tendency towards higher ratings, while electronics and electrical engineering contains 54 percent of the GS-9 (lowest rating reported) level individuals; (3) personnel in the technical evaluation activity classification were proportionally high in the lower salary levels; and (4) there was an interaction between higher GS equivalent levels and a higher incidence of reported information problems.

The type of work activity of Phase I users was investigated in relation to kind and field of task, as well as the use of DDC and DOD Specialized Information Centers. Personnel in the technical evaluation activities used DDC and DOD Specialized Information Centers more often, and were less involved in research than the categories of

scientific, engineering, and administration. Also those individuals associated with aircraft and flight equipment tasks were shown to be high in technical administration. The Phase II data reflect the low proportion of technical evaluation activity personnel in research tasks, but show no significant interaction for aeronautics and space technology to type of activity; and indicate that the technical evaluation category was related to not knowing of the existence of DDC or other Specialized Information Centers.

Kind of position in Phase I was related to kind of task, with approximately 75 percent of the individuals staying within the task kind category associated with their normal work position. These "categories" were combinations of various sub-categories into research, development, reliability and quality control, and R&D support. When Phase II data are likewise grouped, the interaction of position to task stayed about the same (at 25 percent change from a kind of position to another kind of task); but if the sub-categories of basic research, applied research, system analysis, advanced development, etc., are examined, this change of kind between position and task increases to an average of 44 percent. In Phase I there was a high proportion of individuals in research associated with medicinal sciences and physics. This interaction was substantiated by Phase II, with the fields of mathematics and chemistry being added to the high research-oriented list, and aeronautics and space technology showing up as very low in the research categories. Also research was related in Phase I to individuals who found post task information, while in Phase II there was no interaction between post task information and kind of position.

The interaction of the field of position and field of task for Phase I was interpreted as a tendency to be the same. The basic interactions established in Phase I are repeated in Phase II. These are that the greatest change is for individuals in the mathematics position area (48 percent changed task field in Phase I and 56 percent in Phase II) and the smallest change was for medical sciences (6 percent in Phase I and 13 percent in Phase II). The other field categories change about 25 percent of the time in both Phase I and Phase II. Other interactions of field of position are: (1) TAB is used more by personnel in aircraft and flight equipment, materials and metallurgy (there is no interaction between the use of TAB and the field of position in Phase II); (2) as in Phase II, those in the medical sciences use DDC less; (3) mathematics associates with discovering post task information, while ordnance associates with not finding post task information (there is no interaction between the discovery of post task information and field of position in Phase II); and (4) there is no interaction between field of position and the reporting of information problems (the same is true in Phase II).

Class of Information

Class of information was compared with various other questions in Phase I, developing the following interactions: (1) concepts associate with research tasks, longer task durations, and the use of libraries as a first information source; (2) performance and characteristics associate with engineering (development) tasks, and not with research; (3) math aids, formulae and computer programs associate with receipt of one report or document, specific answers, and the use of one's own collection as a first source; (4) raw data associates with a specific answer; (5) technical data associates with a once-over-lightly, and the use of a library as a first source; and (6) there is no interaction between class of information and field of task. The interactions established by the Phase II analysis of the same two-way frequency distributions

produced many more features than the Phase I data, while only indicating the following two similarities with Phase I: (1) there is an association between concepts and research; amd (2) math aids, formulae and computer programs are related to the use of one's own collection as a first source. The lack of similarities in this area is more than likely related to the great differences between Phase I and Phase II samples in SEARCH AND ACQUISITION questions.

First Source for Information

No outstanding interactions of the first source used to acquire information about other questions were defined by the Phase I analysis. Items of interest that were pointed out were that: (1) manufacturers and suppliers were used more for aircraft and flight equipment tasks; (2) libraries were used more often for research tasks; (3) the first source was not dependent upon task time; (4) in 39 percent of the cases, the first source provided all of the information required; (5) a colleague, supervisor or subordinate was frequently a reference to another source; (6) libraries, manufacturers and suppliers, supervisors and subordinates were proportionally high as first sources for information with acquisition times of over 1 week; and (7) that there is no interaction between the desired depth of information and the first source contacted. The Phase II results substantiated the association of libraries with research; that colleagues and supervisors, as well as libraries, give more reference to other sources; and the non-interaction of desired depth with first source. The following Phase II results contradict those of Phase I: (1) aeronautics and space technology is not high for library use; (2) the longer the duration of the task, the farther the individual tends to go for his first source; (3) and the farther the first source is from the individual, the longer the acquisition time. Also the percentage of cases where all the information was received from the first source was 47 percent in Phase II.

Volume of Information

No significant patterns were established for the desired volume of information, other than the interaction with desired information acquisition time. As the maximum allowable acquisition time increased, the desired volume increased (as was evidenced in Phase II). There was no interaction between the desired volume of information and the usefulness of title listings or abstracts in Phase I; while in Phase II, as desired volume increased, so did the usefulness of title listings or abstracts. In both Phase I and Phase II, there was no significant interaction between desired volume of information and the kind of task.

Depth of Information

Desired depth of information showed no interactions or significant pattern when paired with task duration, first source for information, or kind of task in Phase I. The lack of interaction between depth of information and task duration and first source for information is repeated in Phase II; although a slight trend appears in the two-way frequency distribution for desired depth and kind of task, which indicates that as you move from research tasks, away from nature, and towards customer relations, there is a lessening in the need for great depth.

Information Acquisition Time

When actual acquisition time was matched with the relative duration of the task in Phase I, the two-way frequency distribution "shows no significant pattern," while the

Phase II results indicate that as task duration increases so does the length of time taken to acquire information. Kind of task also showed "no significant pattern" in Phase I when compared to desired acquisition time "with one exception, that research tasks rarely require information in less than one day." This association of research with long acquisition times was borne out by Phase II results, and can be partially explained in both phases by the association of research with longer task durations.

Summary

In summary the interactions, indicated by the Phase I two-way frequency distributions and described in the Phase I Final Report, are contradicted about as often as they are substantiated by the Phase II data. This, however, is not surprising in view of the many differences between the two samples, as demonstrated above.

The general areas of agreement are:

- Post task information and depth of information media are not related to the other survey questions.
- The user's level, as measured by his GS rating and highest degree, are related to the use of formal information systems and the encounter of difficulties in the acquisition and use of information.
- There is a general tendency for some 25 percent of the users to do the kind or field of tasks which are outside their normal kind or field of position.
- Research tasks are proportionately high for the medical sciences and physics, the utilization of concepts, and the use of libraries as a first source for information.
- There is an interaction between the desired volume of information media and the actual acquisition time.

When the differences indicated by comparison of the Phase I and Phase II two-way frequency distributions are considered in relationship to the design or operation of an information system (center or service), the following seven items stand out. In each instance, the Phase I Final Report indicated that either there was no significant interaction or a specific contradicting characteristic. The defense industry study indicates that:

- Desired volume of information media is related to the usefulness of title listings or abstracts; that is, as the desired volume increases, the usefulness of title listings or abstracts increases.
- Longer task durations are associated with the use of a first source for information which is more distant from the user and a longer acquisition time.
- Information whose first source is more distant from the user takes longer to acquire.

- There is an interaction between desired depth of information media and the kind of task indicating that as one moves through the research, development and production cycle (away from research and towards an end product), there is a lessening in the desire for great depth of information media.

- Performance and characteristics data do not exhibit an association with any specific kind of task, but are about equally distributed within all kinds of tasks.

- There is no interaction between kind or field of position and discovery of post task information.

- There is an interaction between the user's equivalent GS Rating and the encounter of difficulties in the acquisition and use of information.

The comparison of the two-way frequency distributions discussed in the Phase I Final Report and the corresponding Phase II two-way frequency distributions are presented in Table 7-5. Forty-three of the 46 two-way frequency distributions from Phase I have been included in this comparison. (The three two-way frequency distributions not compared, due to lack of a common base for comparability, are class of task vs. class of information, user's MOS vs. information difficulties, and class of information vs. actual composition of information media.) The comparison presents the Phase I conclusion concerning the two-way frequency distribution and the indications of the Phase II data.

These indications of the Phase II data are:

- The Chi-square (χ^2) computed by the computer program to measure the departure of the two questions from being independent.

- The degrees of freedom (df) for χ^2.

- The probability of that value of χ^2 being exceeded if the two questions were independent (α).

- The correlation (r) of the two questions.

- The remarks regarding the two-way frequency distribution.

An association is considered to be proportionately high or low when its two-way frequency distribution entry differs from the product of its column and row totals by at least 50 percent. For instance, technical evaluation (as a type of activity) is considered to be proportionately high for test or evaluation, reliability and quality control, and customer relations (tasks) in the two-way frequency distribution for Question 9 vs. Question 54.

Table 7-5. Comparisons of Phase I and Phase II Two-Way Frequency Distributions

Two-way Frequency Distribution				Phase II Conclusion				
Phase II	Phase I	Description	Phase I Conclusion	χ^2	df	α	r	Remarks
Q32 versus Q55	Q45 versus Q1	Discovery of Post Task Information versus User's Equivalent GS Rating	"There is no relationship between a person's rating and whether or not he has found post-task information."	10.71	11	$\alpha > 0.05$	0.0054	No significant difference.
TYPE OF POSITION								
Q39 versus Q54	Q50 versus Q9	Use of DDC versus Type of Position	"Technical evaluation people were found to use DDC relatively more than detailed scientific and engineering or administrative people."	42.19	8	$\alpha < 0.0005$	0.1114	Those with high proportion of the "don't know of DDC" responses are technical evaluation and administrative management personnel.
Q40 versus Q54	Q52 versus Q9	Use of DOD Specialized Information Centers versus Type of Position	"Technical evaluation (personnel) were found to use information centers relatively more..."	38.11	8	$\alpha < 0.0005$	0.1135	Interesting features: a. Low use by medical sciences and research equipment personnel. b. Medical sciences and mathematics personnel show high proportion of those who "know of the centers, but do not use them"
Q9 versus Q54	Q14 versus Q9	Kind of Task versus Type of Position	"Research tasks require primarily detailed scientific and engineering people and proportionally less technical evaluation and administration."	149.37	44	$\alpha < 0.0005$	0.0515	Features of interest: a. Technical evaluation: high proportion for test and evaluation, reliability and quality control, and customer relations; low for research. b. Scientific and engineering: low proportion for customer relations. c. Technical management: high proportion for reliability and quality control and a low proportion for customer relations. d. Administrative management: high proportion for production end-items and customer relations. e. Both technical and administrative management: a high proportion for customer relations.
Q10 versus Q54	Q12 versus Q9	Field of Task versus Type of Position	"Shows that in the field of Aircraft and Flight Equipment, relatively more people were engaged in technical administration and fewer in detailed scientific and engineering work."	70.16	32	$\alpha < 0.0005$	0.0967	There is no definite trend. Features of interest: a. Technical evaluation: no medical science tasks and low in mathematical tasks. b. Scientific and engineering: no relative differences.

Table 7-5. (Cont)

Two-way Frequency Distribution		Description	Phase I Conclusion	Phase II Conclusion				Remarks
Phase II	Phase I			χ^2	df	α	r	
Q10 versus Q54	Q12 versus Q9	Field of Task versus Type of Position (Cont)						c. Technical management: no mathematical and few production. management.and social science tasks. d. Administrative management: no production, management,and social science and mechanical, civil, industrial and marine engineering tasks. e. Both technical and administrative management: a high proportion in production, management, and social science and medical tasks.
KIND OF POSITION								
Q9 versus Q55	Q14 versus Q10	Kind of Task versus Kind of Position	"People normally engaged in a particular kind of activity were found to be engaged in the same kind of task."	4738.71	121	$\alpha<0.0005$	0.6556	The following are the incidence of high proportion cross-over (Activity to Task): a. Applied research: to system analysis (24 percent); advanced development, R&D support, and test or evaluation (15 percent each) b. System analysis: to operational system development (28 percent) c. Advanced development: to engineering development (32 percent) and applied research (25 percent) d. Engineering development: to operational system development (23 percent); advanced development and test or evaluation (20 percent each) e. Operational system development: to test or evaluation (22 percent); system analysis, engineering development, R&D support, and production end-items (13 percent each) f. R&D support: to system analysis, applied research, and test or evaluation (20 percent each) g. Test or evaluation: to reliability and quality control (24 percent); applied research and system analysis (15 percent each) h. Production processes: to test or evaluation (34 percent) or production end-items (19 percent) i. Production end-items: to production processes (31 percent), and operational system development (22 percent)

Table 7-5. (Cont)

Two-way Frequency Distribution		Description	Phase I Conclusion	Phase II Conclusion				Remarks
Phase II	Phase I			χ^2	df	α	r	
Q9 versus Q55	Q14 versus Q10	Kind of Task versus Kind of Position (Cont)						j. Reliability and quality control: to test or evaluation (34 percent); applied research, system analysis, and operational system development (17 percent each) k. Customer relations: to R&D support (23 percent); engineering development (18 percent) The least amount of cross-over was for basic research (20 percent) and reliability and quality control (29 percent). The highest amount of cross-over was for engineering development (66 percent) and customer relations (65 percent). On the average 44 percent of the personnel crossed from a position kind to a different task kind. When kind categories are pooled as in Phase I, the cross-over rate drops to about 25 percent.
Q10 versus Q55	Q12 versus Q10	Field of Task versus Kind of Position	"Research people were doing relatively fewer tasks in the fields of Aircraft and Flight Equipment and more in the fields of Medicine and Physics, Fluid Mechanics and Nuclear Physics. Conversely engineering people were found to be performing relatively fewer tasks in the fields of Aircraft and Flight Equipment, Guided Missiles, and Medicine and more in the field of Research and Research Equipment."	575.01	88	$\alpha < 0.0005$	-0.1725	The field groupings show high proportions as follows: a. Production, management, and social sciences: production processes, production end-items, reliability and quality control. b. Medical sciences: research - there are entries in only research, R&D support, operational system development and system analysis. c. Mechanical, industrial, civil, and marine engineering: system analysis and customer relations. d. Aeronautics and space technology: very little basic research. e. Electronics and electrical engineering: no basis research, high in engineering development. f. Chemical sciences and materials: basic and applied research. g. Physical science: basic and applied research. h. Research and research equipment: system analysis and operational development. i. Mathematics: Basic and applied research.

Table 7-5. (Cont)

Two-way Frequency Distribution		Description	Phase I Conclusion	Phase II Conclusion				Remarks
Phase II	Phase I			χ^2	df	α	r	
Q32 versus Q55	Q48 versus Q10	Discovery of Post Task Information versus Kind of Position	"Research people tend to find relevant information after task completion more often."	14.61	11	$\alpha<0.05$	-0.0559	They are independent variables. No significant difference.
FIELD OF POSITION								
Q10 versus Q56	Q12 versus Q11	Field of Task versus Field of Position	"Shows a heavy diagonal line which implies that the respondents' fields of endeavor tend to be the same as the fields of the tasks in which they are engaged."	5710.38	64	$\alpha<0.0005$	0.6688	The following are the incidences of high proportional cross-over (Activity to Task): a. Production, management, and social sciences: to mechanical, industrial, civil, and marine engineering (28 percent); aeronautics and space technology, research and research equipment (19 percent each) b. Medical sciences: to aeronautics and space technology (54 percent) c. Mechanical, industrial, civil, and marine engineering: to aeronautics and space technology (32 percent); electronics and electrical engineering (18 percent), Production, management, and social sciences, and chemical sciences and materials (16 percent each). d. Aeronautics and space technology: to physical sciences (25 percent); electronics and electrical engineering and research and research equipment (20 percent each) e. Electronics and electrical engineering: to aeronautics and space technology (48 percent) f. Chemical sciences and materials: to aeronautics and space technology (35 percent), and physical sciences (23 percent) g. Physical sciences: to chemical sciences and materials (28 percent); aeronautics and space technology, and electronics and electrical engineering (20 percent each) h. Research and research equipment: to aeronautics and space technology (23 percent), physical sciences (17 percent); production, management, and social sciences, and

Table 7-5. (Cont)

Two-way Frequency Distribution		Description	Phase I Conclusion	Phase II Conclusion				Remarks
Phase II	Phase I			χ^2	df	α	r	
Q10 versus Q56	Q12 versus Q11	Field of Task versus Field of Position (Cont)						mechanical, industrial, civil, and marine engineering (13 percent each) i. Mathematics: to aeronautics and space technology (34 percent), electronics and electrical engineering (20 percent), chemical sciences and materials, and research and research equipment (12 percent each) Cross-over was usually to aeronautics and space technology (25 percent of all cross-over); the least cross-over was from medical sciences (13 percent), chemical sciences and materials (17 percent). The greatest amount of cross-over took place in mathematics (56 percent). On the average 27 percent of the personnel left their normal field of work for a different field of task.
Q39 versus Q56	Q50 versus Q11	Use of DDC versus Field of Position	"Fields of Fuels and Propulsion System, Physics, Fluid Mechanics and Nuclear Physics use DDC more than people engaged in other fields. People working in the field of Medicine appear to use DDC relatively less than individuals in other fields."	46.62	16	$\alpha<0.0005$	0.0764	Features of interest: a. "Don't know of DDC:" a low proportion in mathematics. b. "Know of, but don't use:" a high proportion in medical sciences; and a low proportion in mathematics c. "Use DDC:" a high proportion in mathematics; and a low proportion in medical sciences.
Q40 versus Q56	Q52 versus Q11	Use of DOD Specialized Information Centers versus Field of Position	"No outstanding pattern."	50.83	16	$\alpha<0.0005$	-0.0030	No real pattern, but slight tendency towards higher management using the centers more.
Q37 versus Q56	Q49 versus Q11	Use of TAB versus Field of Position	"People engaged in the fields of Aircraft and Flight Equipment, Materials and Metallurgy used TAB relatively more than people in other fields."	51.68	32	$0.01<\alpha<0.025$	0.0516	They are independent variables. No significant difference.
Q45 versus Q56	Q56 versus Q11	Encounter of Difficulties versus Field of Position	"No significant relationships."	15.69	8	$0.025<\alpha<0.05$	-0.0206	They are independent. No significant difference, although the medical sciences do show a proportionally greater percentage of problems.

Table 7-5. (Cont)

<table>
<tr><th colspan="2">Two-way Frequency Distribution</th><th rowspan="2">Description</th><th rowspan="2">Phase I Conclusion</th><th colspan="4">Phase II Conclusion</th><th rowspan="2">Remarks</th></tr>
<tr><th>Phase II</th><th>Phase I</th><th>χ^2</th><th>df</th><th>α</th><th>r</th></tr>
<tr><td>Q32 versus Q56</td><td>Q48 versus Q11</td><td>Discovery of Post Task Information versus Field of Position</td><td>"Personnel engaged in mathematical work" find information after task completion more often. "In the field of Ordnance, they rarely found relevant information after task completion."</td><td>3.64</td><td>8</td><td>α>0.05</td><td>0.0051</td><td>They are independent variables. No significant difference.</td></tr>
<tr><td colspan="9">HIGHEST DEGREE</td></tr>
<tr><td>Q45 versus Q50A</td><td>Q56 versus Q4</td><td>Encounter of Difficulties versus User's Highest Degree</td><td>"People with postgraduate degrees tend to express having a serious problem...more than those with bachelor's degrees or those with no degree."</td><td>25.61</td><td>5</td><td>α<0.0005</td><td>0.1179</td><td>No significant pattern is evident, but there is a slight tendency for those with higher degrees to report more problems.</td></tr>
<tr><td colspan="9">CLASS OF INFORMATION</td></tr>
<tr><td>Q28 versus Q9</td><td>Q25 versus Q14</td><td>Class of Information versus Kind of Task</td><td>"Research tasks tend to require relatively more concept information and less performance and characteristics information...Engineering tasks were found to require more performance and characteristics and specifications data..."</td><td>1310.25</td><td>132</td><td>α<0.0005</td><td>0.1083</td><td>High proportion features:
a. Concepts: research
b. Design or design techniques: engineering and operational development
c. Experimental processes and procedures: research, production end-items
d. Test process and procedures: test or evaluation
e. Evaluation: system analysis, reliability and quality control
f. Specifications: reliability and quality control
g. Production: production processes and end-items, reliability and quality control
h. Technical status: customer relations</td></tr>
<tr><td>Q28 versus Q10</td><td>Q25 versus Q12</td><td>Class of Information versus Field of Task</td><td>"No significant difference."</td><td>1028.13</td><td>96</td><td>α<0.0005</td><td>0.0918</td><td>High proportion features:
a. Concept: physical sciences
b. Mathematical aids and computer programs: mathematics, research and research equipment
c. Experimental processes and procedures: medical science, chemical science
d. Production: production, management and social science; chemical science
e. Technical status: medical science</td></tr>
</table>

Table 7-5. (Cont)

Two-way Frequency Distribution		Description	Phase I Conclusion	Phase II Conclusion				Remarks
Phase II	Phase I			χ^2	df	α	r	
Q28 versus Q10	Q25 versus Q12	Class of Information versus Field of Task (Cont)						f. Costs: production, management and social science; mechanical, industrial, civil, and marine engineering
Q14 versus Q28	Q42 versus Q25	Location of First Source for Information versus Class of Information	"No outstanding pattern..two minor features..libraries more as first source for concepts and technical status and...own collection more... for mathematical aids and formulae."	1028.65	168	$\alpha<0.0005$	0.0870	High proportion features: a. Received with task assignment: specifications b. Recalled it: concepts, mathematical aids and formulae, test processes and procedures c. Own collection: mathematical aids and formulae d. Respondents own action: experimental processes and procedures, raw data e. Assigned subordinate to get it: technical status, cost and funding, experimental processes and procedures, evaluation. f. Asked a colleague: mathematical aids and formulae g. Asked supervisor: production process and procedures, specifications h. Libraries: experimental processes and procedures i. External consultant: technical status, raw data, utilization j. DOD services: technical status, cost and funding k. Asked customer: cost and funding
Q28 versus Q21	Q25 versus Q32	Class of Information versus Actual Volume of Information Media	"Mathematical aids and formulae..one *item is sufficient. Generally, however,* no outstanding patterns."	340.98	36	$\alpha<0.0005$	0.0057	Features of interest: a. Mathematical aids and formulae are equally distributed between one report, sampling, and all information available (30 percent, 36 percent, and 34 percent, respectively) b. Specifications have high proportional reliance on one report or document. c. Only other pattern is in recall: a high proportion for: (1) Mathematical aids and formulae (2) Test process and procedures (3) Evaluation

Table 7-5. (Cont)

Two-way Frequency Distribution		Description	Phase I Conclusion	Phase II Conclusion				Remarks
Phase II	Phase I			χ^2	df	α	r	
Q28 versus Q22	Q25 versus Q33	Class of Information versus Desired Volume of Information Media	Same as Q25 versus Q32 table..No relative difference between these two tables." No difference between actual and desired breadth."	329.28	36	$\alpha<0.0005$	0.0027	Although there is a significant difference between breadth desired and received in Phase II, their relationship to class of information is relatively the same.
Q28 versus Q24	Q25 versus Q38	Class of Information versus Actual Depth of Information Media	"Mathematical aids and formulae, and raw data..received as specific answers, technical status received as once-over-lightly."	114.55	24	$\alpha<0.0005$	0.0374	A proportional distribution is evidenced throughout, but concepts are low for specific answers.
Q28 versus Q3	Q25 versus Q17	Class of Information versus Task Duration	"As length of task increases, there appears to be a greater use of concept information."	168.95	96	$\alpha<0.0005$	0.0168	Test process and procedures have proportionally shorter tasks
FIRST SOURCE CONTACTED FOR INFORMATION								
Q12 versus Q14	Q35 versus Q42	Actual Acquisition Time versus Location of First Source for Information	"Several patterns...retrieved in under one week; colleagues, manufacturers, and suppliers are used relatively more...when takes longer then one week; libraries, manufacturers and suppliers, and supervisor and subordinate are more frequently used..."	2823.62	84	$\alpha<0.0005$	0.3963	The farther the first source is from the individual, the greater the retrieval time.
Q14 versus Q17	Q42 versus Q45	Location of First Source for Information versus Acquisition from First Source for Information	"In 39 percent of cases, the first source provided all of information required."...a colleague, a supervisor or a subordinate..was frequently a reference to another source."	355.63	56	$\alpha<0.0005$	-0.1036	Interesting features are: a. 47 percent of cases received all information required from the first source. b. No significant differences within first source for "all information needed" or "part of the information" c. Best first sources: assigned a subordinate to get (67 percent for "all information needed") and received with task (62 percent for "all information needed") d. Worst first sources: supervisor (29 percent for "all information needed") and libraries (34 percent for "all information needed") High proportion features: • Irrelevant information: DOD services, libraries, customer • Nothing: supervisor, customer, external consultant, libraries • Reference to another source: supervisor, libraries, colleague

Table 7-5. (Cont)

Two-way Frequency Distribution		Description	Phase I Conclusion	Phase II Conclusion				Remarks
Phase II	Phase I			χ^2	df	α	r	
Q14 versus Q3	Q42 versus Q17	Location of First Source for Information versus Task Duration	"First source is not dependent..." on task time.	337.48	112	$\alpha<0.0005$	0.1060	The tendency is towards longer tasks using first sources that are more distant from the individual seeking information. High proportion features: a. Received with task assignment: 1-7 days b. Recalled it: 1-7 days c. Respondents own action: 181-270 days d. External consultant: 91-180 days, 181-270 days e. DOD services: 270-365 days, 15-21 days f. Customer: 21-30 days, 31-90 days
Q14 versus Q9	Q42 versus Q14	Location of First Source for Information versus Kind of Task	"No outstanding relationship to a particular source." Libraries used more often as a first source for Research tasks.	500.13	154	$\alpha<0.0005$	0.020	High proportion features: a. Own collection: basic research b. Asked colleague: customer relations c. Asked supervisor: R&D support d. Department files: operational system development e. Internal company consultant: production end-items, reliability and quality control f. Library: basic and applied research g. Manufacturer, vendor or supplier: production processes h. Customer: system analysis
Q14 versus Q10	Q42 versus Q12	Location of First Source for Information versus Field of Task	"No significant pattern between field of task and use of any particular first source, with the one exception that for Aircraft and Flight Equipment tasks, manufacturers were used... more often than any other field."	390.37	112	$\alpha<0.0005$	0.0350	High proportion features: a. Respondents own action: mechanical industrial, civil, and marine engineering b. Assigned subordinate to get it: production, management, and social sciences; and mathematics c. Ask a colleague: mathematics, research and research equipment d. Library: chemical sciences e. External consultant: medical sciences f. DOD services: mechanical, industrial, civil, and marine engineering

Table 7-5. (Cont)

Two-way Frequency Distribution		Description	Phase I Conclusion	Phase II Conclusion				Remarks
Phase II	Phase I			χ^2	df	α	r	
Q25 versus Q14	Q39 versus Q42	Desired Depth of Information Media versus Location of First Source for Information	"No relationship."	87.94	28	$\alpha<0.0005$	0.0464	There is no apparent pattern, thus no real difference.
INFORMATION BREADTH OR VOLUME								
Q13 versus Q22	Q36 versus Q33	Desired Acquisition Time versus Desired Volume of Information Media	"There is no significant pattern... with two minor exceptions...under one day-one specific item, up to 3 months-all information available."	1734.01	15	$\alpha<0.0005$	0.3219	The length of time allowable is greater when a greater breadth of information is desired or vice versa.
Q22 versus Q23	Q33 versus Q34	Desired Volume of Information Media versus Usefulness of Title Listings or Abstracts	"Did not present any significant patterns." Asked question on title listings of only those individuals who desired a large amount of information.	563.50	6	$\alpha<0.0005$	0.2630	As breadth or volume of information increases the use of or value of title listings and abstracts increases.
Q22 versus Q25	Q33 versus Q39	Desired Volume of Information Media versus Desired Depth of Information Media	"Want exposure to one item... searching for a specific answer... no other significant patterns..."	141.37	6	$\alpha<0.0005$	0.0774	Interesting features: a. All from recall: a high proportion of specific answers; and a low proportion of detailed analyses b. A sampling of reports: a high proportion of once-over-lightly; and a low proportion of specific answers
Q22 versus Q3	Q33 versus Q14	Desired Volume of Information Media versus Kind of Task	"No outstanding pattern..."	188.14	33	$\alpha<0.0005$	0.0344	High proportion features: a. A sampling of reports: basic research b. All reports pertinent: production end-items
INFORMATION DEPTH OR DETAIL								
Q25 versus Q9	Q39 versus Q14	Desired Depth of Information Media versus Task Duration	"Shows no significant pattern."	103.84	22	$\alpha<0.0005$	0.0780	There is a slight trend that indicates that the farther from nature the kind of task the less depth is desired. a. Once-over-lightly: customer relations, reliability and quality control, test and evaluation b. Specific answer: no significant differences c. Detailed analysis: basic research
Q25 versus Q3	Q39 versus Q17	Desired Depth of Information Media versus Kind of Task	"Shows no significant pattern."	22.41	16	$\alpha<0.05$	0.0403	They are independent. There is no significant difference.

Table 7-5. (Cont)

Two-way Frequency Distribution		Description	Phase I Conclusion	Phase II Conclusion				Remarks
Phase II	Phase I			χ^2	df	α	r	
			INFORMATION RETRIEVAL TIME					
Q12 versus Q3	Q35 versus Q17	Actual Acquisition Time versus Task Duration	"Shows no significant pattern."	1245.30	48	α<0.0005	0.3354	They are not independent. There is a linear relationship, i.e., the time taken to get information is related to the length of time of the task.
Q13 versus Q9	Q36 versus Q14	Desired Acquisition Time versus Kind of Task	"No significant pattern...one exception, that Research tasks rarely requires information in less than one day."	335.31	55	α<0.0005	-0.1214	They are not independent. There is some negative linear relationship. The closer to nature the task, the more time allowed to get information: High proportion features: a. Recall: basic research high; production low b. Less than 1 day: test or evaluation high; basic research low c. 1-7 days: research low d. 8-30 days: basic research low e. 30-90 days: customer relations, reliability and quality control, and basic research high f. Over 90 days: basic and applied research high.
			SEARCH AIDS					
Q23 versus Q10	Q34 versus Q12	Usefulness of Title Listings or Abstracts versus Field of Task	"Search aids not considered useful in field of Communications and Electronics. More heavily used in Medicine, Physical Sciences."	94.60	18	α .0.0005	0.0048	They are not independent. There is no linear relationship and no apparent pattern. Features of interest: a. Medical sciences use search aids more heavily than do the others. b. Physical sciences not significantly different from rest of population.

7.3 REVIEW OF PHASE I CONCLUSIONS

The Phase I Final Report sets out five conclusions which attempt to "interpret both the meaning of some of the results and their significance to DOD." In this section, these conclusions are reviewed in light of the Phase II data. Each Phase I conclusion is confirmed, if not strengthened, by the Phase II data. However, in almost every case there is a significant difference between the data used to arrive at the conclusions. The most significant differences are in the relative importance of the local work environment as a first source for information and the encounter of utilization difficulties.

Importance of Engineering Data

The first conclusion presented in the Phase I Final Report refers to the importance of engineering data to the scientific and technical community of DOD. The stated conclusion is that "the universal use of engineering data throughout the RDT&E community is a measure of its importance to the RDT&E effort. It is particularly noteworthy that forty-two percent of the users required specifications, performance, and characteristics data in support of their tasks. Continued improvement of the methods for preparation, acquisition, classification, indexing, storage, dissemination, retrieval, and correlation of such engineering data is clearly warranted." This conclusion was drawn from the fact that of all information chunks, 27 percent were categorized as performance and characteristics and 15 percent as specifications. These percentages held up very well in Phase II, where performance and characteristics were indicated for 25 percent of the information chunks and specifications for 15 percent.

Importance of Local Work Environment

On the importance of the local work environment, Phase I concluded that "the user tended to rely heavily on his local environment (51 percent) as a first source for information, which completely satisfied his particular information requirement in 39 percent of the cases. This finding tends to confirm the existence and significance of an informal information system consisting of the user's personal files, his colleagues, and other local sources of information. The features of this informal information system, which the user apparently considers important, are: convenience, responsiveness, and the ability to conduct a dialogue (interplay and feedback). The user apparently wants to deal with a system wherein he can personally explain, clarify, and modify his requirements, and he can expect in response the right information in the right amount, in the right form, and in the time required."

This 51 percent reliance on local work environment as a first source for information was divided among colleagues (21 percent), user's own collection (17 percent), and the departmental files (13 percent). Other elements, the assignment of a subordinate (4 percent) and the asking of a supervisor (2 percent), are really additional units of the local work environment. The inclusion of these two elements into the local work environment increases the Phase I percentage of reliance to some 58 percent.

There are two other definitions of grouped first source for information categories which can be made from the responses to the question, "Who was the first source contacted for this information?" These are "no search required" and "external to the local work environment." The no search required category is

constructed from information chunks received with the task or from recall (listed as blanks in the unpooled Phase I data), which represent 11 percent and 17 percent of the responses, respectively. The external to the local work environment category is a combination of external consultant (1 percent), librarian or technical researcher (1 percent), library (4 percent), information or data centers (0.4 percent), and manufacturer or supplier (5 percent). There is an additional Phase I element listed as other (4 percent), which is not defined and thus not considered in the following analysis.

When the three grouped categories are compared with the corresponding ones for the Phase II data, a difference is evidenced in the use of both local and external to local first sources. (See Table 7-6.)

There is a shift towards external to the local work environment in Phase II, although 50 percent of the information is still sought within the local work environment. One explanation for this shift of some eight to nine percentage points can be derived from looking at the differences within the categories (see Table 7-7).

The difference between Phase I and II seems to be the relative use of one's own collection or action, departmental files and bookcases, library facilities, external consultant or customer, and DOD information or data centers. The DOD sample depended more on their own personal document collections and departmental files and bookcases than did the defense industry sample, while the reverse situation occurred for the use of libraries, external consultants and DOD facilities. Of those information chunks sought from the local work environment by Phase II user's, 45.9 percent were supplied all the information desired by the first source (compared with 39 percent for Phase I). Those first sources which required no search, supplied all the information desired 53.7 percent of the time, while external to local work environment sources provided all information desired 39.5 percent of the time. The local work environment produced a low proportion of irrelevant information, 0.6 percent, as compared to 1.4 percent for external to local work environment sources (see Table 7-8).

Table 7-6. Comparison of Phase I and Phase II Grouped Location of First Source for Information

Response	Phase I*	Phase II	J^2 Contribution
No search required	28.6%	29.6%	1.37
Local work environment	59.5%	50.6%	24.81
External to local work environment	11.8%	19.8%	59.10

$J^2 = 85.28$, $\chi^2 \approx 170.56$, df = 2, $\alpha < 0.0005$

*Adjusted for the 205 other answers.

Table 7-7. Comparison of Phase I and Phase II Ungrouped Location of First Source for Information

Response	Phase I*	Phase II	J^2 Contribution
No Search Required			
Recall	17.5%	18.8%	2.30
Received with task	11.1%	10.7%	0.02
Local Work Environment			
Own collection or actions	18.3%	15.5%	20.48
Assigned subordinate to get information	3.9%	4.4%	1.16
Colleagues (includes internal company consultants)	21.6%	23.7%	4.31
Asked supervisor	2.1%	1.4%	3.60
Departmental files or bookcases	13.6%	5.5%	84.04
External to Work Environment			
Library or librarian	5.4%	9.2%	36.50
Manufacturer or supplier	4.8%	6.0%	4.30
External consultant or customer	1.2%	2.7%	16.10
DOD information or data center	0.4%	1.2%	11.38
			$J^2 = 184.08$

$J^2 = 184.08$, $\chi^2 \approx 368.16$, $df = 10$, $\alpha < 0.0005$

*Adjusted for the 205 other answers.

Importance of Information Analysis

Phase I showed that "the high proportion (68 percent) of requirements for either a detailed analysis or specific answer rather than a once-over-lightly (15 percent), underscores the importance of the information analysis function. The user apparently wants a detailed analysis or specific answer more often than a series of abstracts to documents which may be relevant to his question. The recent emphasis on the establishment of additional formal DOD information analysis centers, as evidenced by DOD instruction 5100.45 entitled Centers for Analysis of Scientific and Technical Information, indicates a recognition of the importance of this function."

Table 7-8. Location of vs. Acquisition from First Source for Information - Phase II

Location	Received	Irrelevant Information	Nothing	Reference	Part of Information	All of Information	Total
No Search Required	Total Row Column	6 0.4% 16.2%	0 0% 0%	33 2.1% 14.0%	695 43.8% 27.7%	851 53.7% 33.9%	1585 100% 29.6%
Local Work Environment	Total Row Column	16 0.6% 43.2%	35 1.3% 60.3%	145 5.3% 61.4%	1272 46.9% 50.6%	1244 45.9% 49.5%	2712 100% 50.6%
External to Work Environment	Total Row Column	15 1.4% 40.5%	23 2.2% 39.7%	58 5.5% 24.6%	545 51.5% 21.7%	418 39.5% 16.6%	1059 100% 19.8%
	Total	37 0.7%	58 1.1%	236 4.4%	2512 46.9%	2513 46.9%	

This preference for analyzed information is also evidenced in Phase II, but a reversal is experienced in the importance of the two components of this analyzed information. (See Table 7-9.)

The data in Table 7-9 has the 795 blank answers, of the 4687 possible answers, removed from the Phase I data under consideration. The preponderance of the blanks are information chunks for which recall was utilized as the first source for information. Using the distribution of recall responses in Phase II as a guideline (once over lightly - 7 percent, specific answer - 72 percent and detailed analysis - 21 percent), the Phase I percentages have been adjusted as in Table 7-10.

Table 7-9. Comparison of Phase I and Phase II Desired Depth of Information Media

Response	Phase I*	Phase II	J^2 Contribution
Once over lightly	18%	7%	13.64
Specific Answer	27%	56%	211.37
Detailed Analysis	55%	37%	129.29
			$J^2 = 354.30$

$J^2 = 354.30$, $\chi^2 \approx 708.60$, df = 2, $\alpha < 0.0005$

*Adjusted for 795 blank answers.

Table 7-10. Comparison of Phase I and Phase II Desired Depth of Information Media, with Phase I Adjusted for Recall

Response	Phase I		Phase II	J^2 Contribution
	Without Recall	With Recall		
Once over Lightly	18%	16%	7%	2.49
Specific Answer	27%	34%	56%	86.99
Detailed Analysis	55%	50%	37%	110.18
				$J^2 = 199.66$

$J^2 = 199.66$, $\chi^2 \approx 399.32$, df = 2, $\alpha < 0.0005$

This adjusted Phase I data shifts in the direction of the Phase II data, but is only slight when considering the large variations between the two samples. Thus, there is a requirement for analyzed information in the defense industry sample; but the emphasis is on specific answers to problems, as opposed to the detailed analysis desired by the DOD RDT&E sample.

Insufficient Use of Information Centers and Services

The DOD RDT&E survey "found that the components of the DOD formal information system (technical libraries, DOD information analysis centers, and Defense Documentation Centers) were not widely utilized. One reason found for the lack of widespread use was a lack of awareness of the existence of the services provided by the DOD formal information system. This, in turn, indicates a lack of effective publicity. Another possible reason may be that the formal information system apparently does not provide the features desired by the user, particularly the features of convenience, responsiveness, and the ability to conduct a dialogue with the system. It appears that what is required is a means for effectively integrating the formal and informal information systems so that the user actually becomes an integral part of the system. Until this is accomplished, it seems that even greatly improved formal information centers will meet with less than a full measure of success."

The use of DOD formal information centers and services by defense industry personnel is significantly different (below the 0.0005 significance level) from that of DOD RDT&E personnel with respect to DDC, TAB and DOD Specialized Information Centers. The greatest differences involve those who do not know of DOD Specialized Information Centers, and those who do not know of DDC. (See Table 7-11.) This awareness problem is prevalent to an even greater extent in the defense industry and may be attributed to a lack of effective publicity. Therefore the 32 percent to 43 percent of the defense industry sample who are unaware of TAB, DDC or the DOD Specialized Information Centers should be made aware of them and their use. However, among those individuals who know of formal information centers and services, between 30 percent and 40 percent still do not use them (see Table 7-12). This group of aware non-users could possibly provide a clue to system requirements, deficiencies, and limitations.

Dissatisfaction with the Ability to Obtain Information

The Phase I Final Report drew the conclusion that "although a majority of the users did not experience any difficulty in locating or obtaining information, it does not necessarily follow that there are no serious information problems." The reasons for this conclusion were stated as: "(1) a sizeable minority (27 percent) did report having problems in locating or obtaining information; (2) user judgment is not the sole criterion for determining whether an information problem exists . . . ; (3) there may be a number of areas in which tools would materially help the user in the acquisition of information, irrespective of whether he presently thinks he has a problem; and (4) a serious information problem may exist with certain types of information, but not with others. For example one area identified by those who claimed to have a problem was the need for information on current R&D projects in progress."

Table 7-11. Comparison of Phase I and Phase II Use of DOD Information Centers and Services

	Phase I	Phase II	J^2 Contribution
Use:			
DDC	47%	45%	0.18
TAB	43%	35%	5.76
DOD Specialized Information Centers	55%	44%	9.68
Know of, but do not use:			
DDC	32%	23%	11.42
TAB	17%	22%	2.26
DOD Specialized Information Centers	26%	19%	7.05
Do not know of:			
DDC	21%	32%	16.28
TAB	40%	43%	1.71
DOD Specialized Information Centers	19%	37%	42.89

DDC: $J^2 = 27.88$, $\chi^2 \approx 55.76$, df = 2, $\alpha < 0.0005$

TAB: $J^2 = 9.73$, $\chi^2 \approx 19.46$, df = 2, $0.005 < \alpha < 0.01$

DOD Specialized Information Centers: $J^2 = 59.62$, $\chi^2 \approx 119.24$, df = 2, $\alpha < 0.0005$

Within Phase II, 42 percent of the users reported information problems. Some 35 percent reported restrictions (i.e., proprietary or security classification), 43 percent reported difficulties in acquiring and using information, and 20 percent found post task information that was relevant to the task (occurred in 13 percent of the cases in Phase I). This indicates that the conjecture of Phase I regarding user dissatisfaction and information problems has a foundation in fact.

Table 7-12. Comparison of Phase I and Phase II Aware Nonuse of DOD Information Centers and Services

	Phase I		Phase II	
	n		n	
DDC:				
Know of	1084		1027	
Know of, but do not use	444	41.0%	348	34.0%
TAB:				
Know of	832		851	
Know of, but do not use	248	29.8%	325	38.2%
DOD Specialized Information Centers:				
Know of	1099		951	
Know of, but do not use	349	31.8%	290	30.5%

These negative indications of the user satisfaction with his ability to obtain information were summarized in Phase II by a general index representing problems (P), which combined the encounter and nature of restrictions and difficulties (Questions 42, 43, 45 and 46). An additional measure was derived to indirectly describe dissatisfaction. It is an index composed of the differences between the desired and actually received information and describes the inadequacy of the search and acquisition process (I). The Phase II data indicate that restrictions, difficulties, dissatisfaction, etc. are related to the user's education, kind of position, level, use of information centers and services, the characteristics of the desired and actually received information, and the characteristics of the task. This relationship can generally be stated as: the higher the level of user, task, use of information center or service, or search and acquisition process, the more likely the user is to have problems in acquiring information.

7.4 CONCLUSION

These two samples from the DOD RDT&E and defense industry scientific and engineering communities are different in many individual aspects. However, as general users of scientific and technical information, they show many similar trends. Together they represent the universe of originators and users of DOD scientific and technical information.

The Phase I and Phase II studies have produced a mass of data concerning the scientific and technical information process and these data should be employed to their maximum utility. Therefore, the application of the more powerful analytical tools of Phase II to the Phase I data, performing a more thorough analysis of the similarities and differences between the samples, and combining the samples for analysis should be considered.

8. RECOMMENDATIONS[1]

The two surveys of user needs within the Government and defense industry environments have yielded a wealth of valuable data relating to the scientific and technical information flow process. The analysis of these data, notwithstanding cost and schedule limitations inherent in an exploratory research project, has resulted in useful but preliminary insights into and explanations of the flow process. However, there are abundant lodes of information yet to be discovered, mined and refined, in order to exploit more fully the economic value of the available data base.

The Phase II study was a pioneering attempt to draw comprehensive, definitive and unifying conclusions from data on a large portion of the flow process. From the perspective gained in this study, it is clear that certain portions of the flow process merit further investigation and that there is considerable room for refinement and extension of the analysis.

The present study has provided a valuable basis for this further investigation and refinement. In addition to yielding guidelines for management decisions, it has also provided:

- A structure and its numerical description with which to view, construct and estimate models describing the information flow process.
- A framework for designing field experiments, performing estimation and testing hypotheses concerning the flow process.
- A methodology for overcoming the analytic deficiencies in past and present user needs studies[2] by the relationship analysis cycle of transforming qualitative question responses into numerical form, constructing and estimating multivariate models for relationships within the flow process, and then transforming the numerical relationship results back to qualitative form.
- A basis for the recommendations which follow concerning: (a) additional field experimentation regarding the flow process; (b) a program for coordinating additional field experimentation and computer simulation in the analysis and optimization of the flow process[3]; and (c) refined analysis of the data from the Phase I and Phase II studies.

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[1] Since the discovery and exploitation of the desired information is subject to the law of diminishing returns, the recommendations are goals and should be assigned priorities according to the twin criteria of objectives and available resources.

[2] Noted by H. Menzel in Chapter 3of Reference 2, and by B. Griffith and W. Paisley during the Progress Review Panel on Information Needs and Uses at the 29th Annual Meeting of the American Documentation Institute, October 3-7, 1966.

[3] The flow process is optimized when its effect upon the performance of a scientific or technical task is optimized.

8.1 ADDITIONAL FIELD EXPERIMENTATION

In order that the implications of Phase II be fully exploited, the flow process merits further investigation. There should be additional field observation, experimentation, and analysis regarding the flow process. A brief discussion of some potentially informative and rewarding field experiments is now presented.

Examples of experiments which are suggested by the Phase II analysis are presented first. For the reader's convenience, some appropriate experiments which have been proposed by others are then noted.

The Phase II analysis suggests additional field experimentation with, and observation of:

- The feasibility, and effect upon the flow process, of the guidelines for management decisions in Section 1.
- The effect of the user's unfamiliarity with the desired kind, class, and field of information upon the search and acquisition process.
- The effect of the quality of information obtained within the local work environment upon the quality and speed of task performance.
- The problems encountered in the utilization of information centers and services, with an emphasis upon separating those attributable to "inside" the company from those attributable to "outside" the company.
- The users who know of, but do not use, information centers and services.
- Task-oriented, rather than general, use of information centers and services.
- Those characteristics suggested by refined analysis of the data.

In the past and present literature concerning the flow process, many field experiments have been proposed. Some of the more pertinent and promising experiments are:

- Those in Reference 3 concerning: (a) dissemination of documents; (b) dissemination of scientific and technical intelligence information (i.e., what is going on); (c) organization and analysis of information in selected fields; (d) indexes, title listings, abstracts, and catalogues in selected fields; (e) Specialized Technical Information Centers; (f) techniques for processing information; and (g) evaluation and improvement of technical writing.
- Those in Chapter 3 of Reference 2.
- Those in Reference 7, which is entirely devoted to scientific communication and appeared while this final report was in publication.

8.2 A PROGRAM FOR ANALYSIS AND OPTIMIZATION

The flow of scientific and technical information has a profound, but as yet uncharacterized, effect upon the performance of scientific and technical tasks. In

their efforts to improve task performance, both DOD and its contractors have made large investments in information centers and services. Optimization of the flow process will produce substantial benefits in terms of quality, resources and time.

The flow process and its effect upon task performance are quite complex, and field experimentation regarding them is both difficult and expensive. For such processes, mathematical solution is usually not feasible, and computer simulation is often an effective and efficient means to complement field experimentation.

When the model (mathematical representation) for the process is translated into a simulation computer program (computer representation) for the process, the process and the effects of various factors upon it may be simulated. The accuracy and precision of the computer simulation increase as the accuracy and precision of the model increase. Therefore, computer simulation yields appropriate results at any stage of one's knowledge about a process, ranging from relative ignorance to relative certainty.

There are four periods in the evolution of a body of knowledge, as it matures from an art into a science: description, modeling, prediction, and control and optimization. With the completion of Phase II, knowledge concerning the flow process is emerging from the description period and entering into the modeling period.

Specific recommendations for additional experimentation have already been given. We now briefly describe a general program to coordinate field experimentation and computer simulation in the analysis and optimization of the flow process. This program (see Figure 8-1) is an improvement of one which was developed by North American Aviation, Inc., and is currently being utilized by a government agency on a process of comparable complexity.

Outline of the Program

The program, which is adaptive in nature, is composed of ten basic stages:

1. Quantitative process analysis to transform the elements of the process into numerical form and to construct a model, with unspecified constants, for relationships among component parts of the process.

2. Process experimental trial(s) to yield experimental data.

3. Process model estimation to produce estimates of unspecified constants in the model from experimental data and available auxiliary data.

4. Simulation programming to construct a process simulation computer program from the model.

5. Process simulation trial(s) to yield simulation data.

6. Process model and simulation data comparison to provide a validation (i.e., positive check) for the simulation computer program.

7. Process experimental and simulation data comparison to provide a validation for the combination of model and simulation computer program.

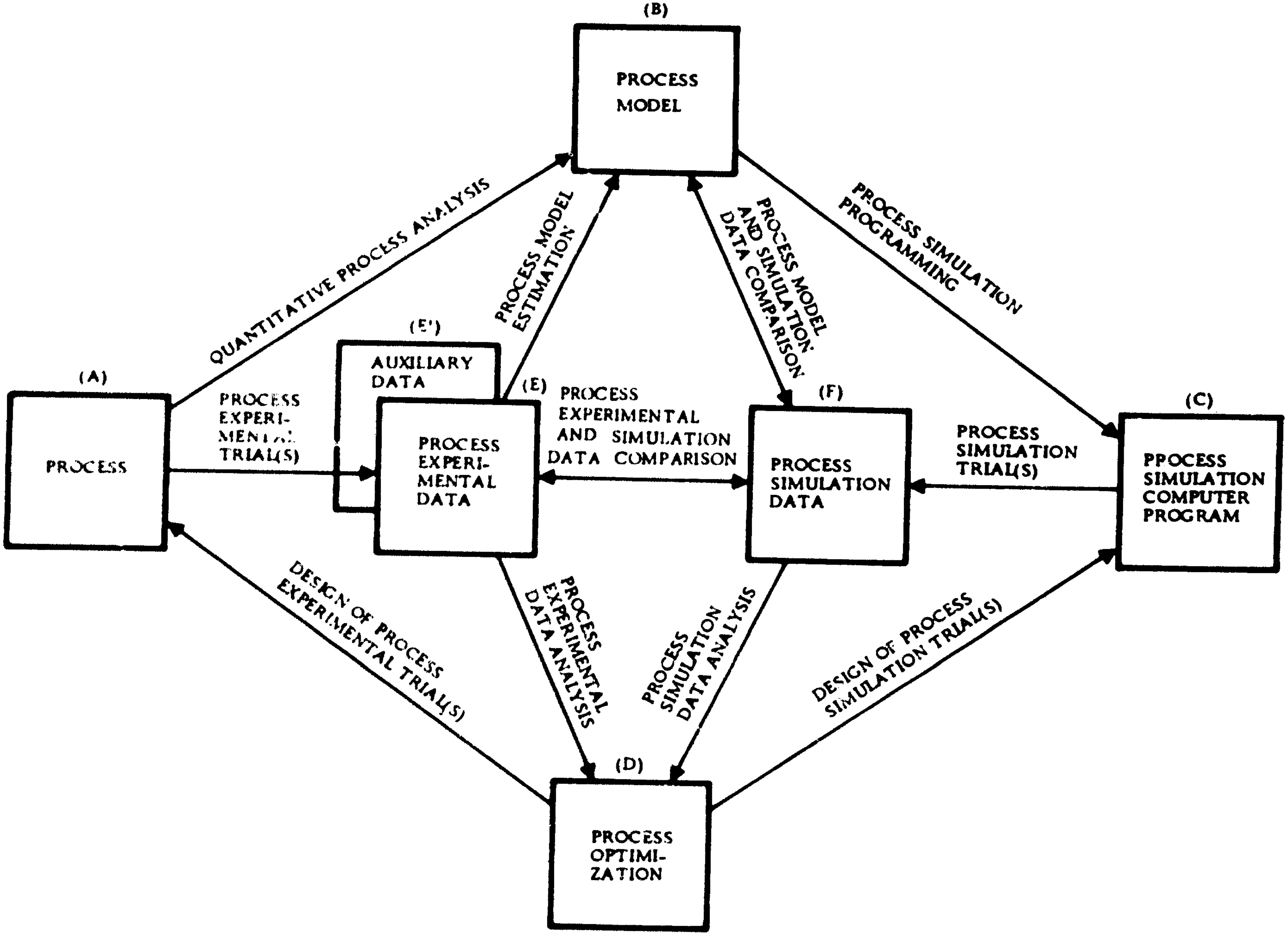

Figure 8-1. Program for Analysis and Optimization

8. Process experimental and simulation data analysis to aid optimization by suggesting improvement of the process.

9. Process optimization to iteratively improve the process and apply appropriate stages of the program to the improved process.

10. Design of process experimental and simulation trials to implement process optimization.

View of the Program

The program, outlined above and graphically portrayed in Figure 8-1, may be viewed as a double diamond.

Its outer portion (composed of AB, AE, BC, CF, DA, and DC) contains those stages of the program which precede the generation of process data and so are not data-based. On the other hand, its inner portion (composed of EB, BF, EF, ED, and FD) contains those stages which follow the generation of process data and so are data-based.

The process model and the simulation computer program are developed and validated via the stages which comprise the upper portion of the double diamond (AB, AE, EB, BC, CF, BF, and EF). Then the analysis of process data and the design of experimental and simulation trials to optimize the process are performed by those stages which comprise the lower portion of the double diamond (ED, FD, DA, and DC).

Development of the model, and the design, performance and analysis of experimental trials are accomplished via those stages in its lefthand portion (AB, AE, EB, ED, and DA). Finally, its righthand portion (BC, CF, BF, EF, FD, and DC) contains those stages concerned with developing and validating the process simulation computer program, and designing, performing and analyzing simulation trials.

The inherent symmetry and simplicity of the double diamond, and the program that it represents, provide a logical framework for proposing, planning, conducting and managing investigations of the process.

Discussion of the Program

Let the process be composed of components, the components contain component parts, and the component parts have elements. For the Phase II data, the component parts are questions and the elements are question responses. Deeper levels of process composition could be considered, if necessary.

The transformation of process elements into numerical form is accomplished in two steps:

- A detailed structure for the process is developed by grouping the related elements in a component part and arranging these groups (and to the extent possible, the elements within groups) into an informative order. The grouping and arranging are based on the primary unifying characteristic of the elements in the component part, as determined from the elements themselves and the function of the component part.

- A numerical description of the detailed structure is defined by associating a number with each ordered element. The base point or zero for a numerical scale is selected according to the primary unifying characteristic of the component part. With each element, there is then associated a numerical value corresponding to its relative "distance" from the base point.

Next the construction of a process model for relationships among component parts is performed in the following three steps.

- Groups of related component parts within a component, and components themselves are arranged into an informative and unifying order to form a general structure. To the extent feasible, the arrangement should be based on the desirable characteristic that a component part tends to influence only those component parts which follow it.
- Groups of related component parts are combined whenever possible in order to simplify the specification and estimation of the process model. Two of the simplest types of combinations are sums (or averages) and products.
- Models are specified for relationships among component parts and combinations of component parts in the general structure. These models comprise the process model, which is a mathematical representation of the process.

It is frequently both convenient and sufficiently accurate (e.g., during exploratory research) to let the process model be composed of linear models for the relationships. In addition, the model should contain random influences if the process contains them.

The model becomes completely specified once values are assigned to its unspecified constants; and the usual way of accomplishing this is to estimate them from experimental data and available auxiliary data via statistical estimation techniques (e.g., regression analysis). A process model which admits good estimators of its unspecified constants is preferable to a more exact one which admits only poor estimators.

Section 4 has described the application of quantitative process analysis and model estimation to the Phase II data.

A process simulation computer program transforms the model's mathematical representation of the process into a computer representation of the process. Input data is required for the simulation computer program to produce a simulation trial.

Although frequently overlooked or ignored, validation should be provided for the model and simulation computer program. When the simulation computer program has been validated to insure that it adequately represents the process model, then the combination of model and simulation computer program ought to be validated to insure that their combination adequately represents the process. The required comparisons, of the model and simulation data followed by that of experimental and simulation data, are performed by statistical testing techniques (e.g., analysis of variance). When the process and model contain random influences, the same inputs may yield different sets of experimental and simulation data; and the validation comparisons should take this randomness of the data into account. Experimental and simulation data analysis aids optimization by suggesting improvement of the process. The analysis is accomplished via both statistical estimation and testing techniques.

Since few processes cannot be improved, one of the most important stages is optimization through iterative improvement of the process and repetition of the appropriate program stages. The design of experimental and simulation trials is, of course, achieved by the techniques of statistical design of experiments.

8.3 REFINED ANALYSIS OF THE DATA

Since only a small fraction of the effort expended in collecting data is typically devoted to its analysis, a large amount of the information generally is undiscovered and unexploited.

A more profound understanding of the DOD/defense industry information flow process can be achieved through more refined analysis of the data, as suggested below:

- More thorough examination of the distribution of answers to questions, and the relationships among questions.
- Investigation into the effect of company size, industry and interviewer bias on the answers to questions.
- Improvement in the arrangement of responses to a question, and the association of a numerical value with each response to a question, with the objective of improving the linearity of relationships among questions.
- Incorporation into the analysis of differences between the corresponding characteristics of the desired and actually received information, and additional special indices.
- Reformulation and re-estimation of appropriate models for relationships among questions, in order to reflect the above improvements and to investigate more specific relationships which involve only single questions (rather than combinations of related questions).
- For purposes such as the study of the selective dissemination process, formulation of reverse models to study the flow process in reverse (i.e., reverse the input/output relations described in Sections 1 and 6). An example would be a model relating the user's highest degree to the class of information, desired composition and layout of the information media, the first source for the information, and the usefulness of title listings or abstracts.
- Formulation and estimation of additional models describing the flow process, and utilization of additional analytical techniques (such as factor analysis).
- Division of the sample of 1500 users into appropriate subsamples to permit analysis and comparison of special groups, such as the three groups that acquired information that is: (a) conceptual, (b) design and performance, and (c) production.
- Application, as appropriate, of the above suggestions in making further analyses of the Phase I data, the similarities and differences of the Phase I and Phase II data, and the combined data from Phase I and Phase II.

APPENDIX I. PARTICIPATING ORGANIZATIONS

Organization	Number of Persons Interviewed	Population of Qualified Personnel
Aerospace Corporation	25	1800
Allegheny Ludlum Steel Corporation	1	80
Allis-Chalmers Manufacturing Company	2	185
American Machine & Foundry Company	1	100
Ampex Corporation	10	760
Arthur D. Little, Inc.	7	800
Armstrong Cork Company	4	210
AVCO Corporation, Research and Development Division	31	3500
The Babcock & Wilcox Company	3	250
Battelle Memorial Institute	11	775
Bechtel Corporation	1	70
Beech Aircraft Corporation	6	470
Bell Aerosystems Company	11	1000
Bell & Howell Research Center	3	500
The Bendix Corporation	6	500
Bissett-Berman Corporation	1	65
The Boeing Company	64	6600
Colt Industries, Inc.	8	725
Cornell Aeronautical Laboratory, Inc.	6	450
Corning Glass Works	5	450
De Laval Turbine, Inc.	2	160
Douglas Aircraft Company, Inc.	66	8645
Dupont Company, Inc.	45	3200
Electric Storage Battery Company	1	200
Emerson Electric Company of St. Louis	5	325
Fairchild-Hiller Corporation, Republic Aviation Division *	1	
GCA Corporation, Technology Division	3	145
General Dynamics Corporation	129	13155
General Precision, Inc., Link Group	8	315
Goodway Printing Company, Inc.	3	200
Hamilton Watch Company	1	110
Hazeltine Corporation	10	800
Hercules Powder Company	23	1350
Honeywell, Inc., Aeronautical Division	12	910
HRB-Singer, Inc.	6	385
IBM, Federal Systems Division	34	3780
Ingersoll-Rand Company	1	55
Institute for Defense Analysis	15	400
Institute of Science & Technology	4	475

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* This person had just joined the company at which he was interviewed. The interview responses reflect his position, task, etc., at Republic Aviation.

APPENDIX 1 (Cont)

Organization	Number of Persons Interviewed	Population of Qualified Personnel
International Harvester Company, Solar Division	4	250
International Resistance Company	1	65
Johns Hopkins University, Applied Physics Laboratory	14	860
Kollsman Instrument Corporation	4	250
Lear-Siegler, Inc., Power Equipment Division	9	255
Leesona Moos Laboratories	1	100
Ling-Temco-Vought, Inc.	63	3500
Loral Electronics Systems	4	350
Lord Corporation	2	125
Lundy Electronics & Systems, Inc.	1	60
Management Systems Corporation	1	20
Massachusetts Institute of Technology	32	2000
Monsanto Company	44	3500
Martin Company	100	7000
McDonnell Aircraft Corporation	27	1900
Melpar, Inc.	8	900
Menasco Manufacturing Company	1	65
North American Aviation, Inc., Columbus Division	21	1570
North American Aviation, Inc., Divisions in the Los Angeles Metropolitan Area	269	18590
Northrop Corporation	29	1730
Olin Research Center	4	300
Otis Elevator Company	1	50
Philco Corporation	26	5000
Pittsburgh Plate Glass Company	3	225
The RAND Corporation	11	750
Raytheon Company	49	4000
Remington Arms Company, Inc.	3	135
Simmonds Precision Products, Inc.	2	190
Sparton Corporation, Electronics Division	1	35
Sperry Gyroscope Company	9	650
Sprague Electric Company	7	540
Stanford Research Institute	17	1220
System Development Corporation	25	850
Texas Instruments, Inc.	25	1500
Thompson Ramo-Wooldridge Inc., Equipment Laboratories	7	450
The Timkin Roller Bearing Company	5	355
United Aircraft Corporation, Norden Division	4	275
United Aircraft Corporation, Sikorsky Aircraft Division	18	1125

APPENDIX 1 (CONT)

Organization	Number of Persons Interviewed	Population of Qualified Personnel
United States Steel Corporation	9	700
University of Pittsburg	7	500
University of Southern California	29	1400
Vickers, Inc.	5	380
Western Electric Company	1	120
Westinghouse Electric Corporation	22	1730
	1500	119,470

APPENDIX 2 EXPLANATORY NOTES TO MODIFICATION OF PHASE I INTERVIEW GUIDE

These notes reflect discussions held in San Francisco on 8 June 1965, and regard interview modification. The draft Interview Guide Modification, dated 23 June 1965, is based on the results of these discussions.

Part 1 (Old Part II)[1]

The note to "interviewer" has been clarified, and the modifier "significantly" added to "less than 8 hours" (per W. Carlson).

Question 1 (old 12) - Dropped the exploratory question (a), (b), (c), and referred interviewer to the Handbook which covers these items in detail. It is felt that such specific leading questions are not appropriate or useful in all cases and might mislead the interviewee. Also, the interviewer should have greater freedom to guide the exploratory questioning in order to establish initial rapport.

Question 2 (old 13) - Dropped the term "section" (per W. Carlson).

Question 3 (old 14) - Combined "Research" categories (old A, B) into new "A," and "Development categories (old C, D, E) into new "B" to eliminate misinterpretation and possible confusion. Operational definitions are not mutually exclusive, and the proposed combination should be more meaningful. Note that Phase I Analysis combined these categories.

Added new categories D, E, and F to cover DOD - Defense Contractor orientation. The "other" category has been eliminated in order to encourage a specific response. Also, Phase I Analysis showed only 4 percent in the "other" category. If the interviewer cannot classify, the entry will be left blank and an explanation entered on the page.

Question 4 (old 94) - This question which, in Phase I, was directed to the interviewer has now been more appropriately redirected to the interviewee and placed into Part I.

Question 5 (old 15 and 16) - Combined these questions since they both are related to task origination. Clarified task assignment by identifying source of assignment or origination. Added categories E and F as appropriate additional categories. Phase I analysis indicates that these questions as originally phrased were not well understood; i.e., low reliability.

Question 6 (old 17) - Clarified to elicit "elapsed time" rather than man-days (per W. Carlson).

Question 7 (old 18) - Recategorized responses into more meaningful time segments.

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[1] The number of the "old questions" are those of the Interview Guide, May 14, 1965, to be found in Vol. II of the Final Report, Phase I (Reference).

Question 8 (old 20) - Added categories D, E, and F to reflect industry orientation. Added "other" category to elicit possible unique outputs.

Question 9 (old 19, 21, 22) - Combined these series of questions into one meaningful response sequence. Also, differentiate between oral and written outputs.

Question 10 (old 23) - Reoriented to industry.

Question 11 (old 24) - No change (per W. Carlson).

Question 12 (old 25) - "Chunk," "Class" List moved to Reference Manual.

Question 13 (old 26) - No change.

Old question 27 - Eliminated (per instruction of W. Carlson).

Question 14 (old 28) - Media are listed in Reference Manual. Question has been structured based on response received during Phase I and subsequent analysis. Space has been provided to indicate order of preference (up to three).

Question 15 (old 29, 30) - Old questions 29 and 30 combined into a more meaningful series of responses.

Question 16 (old 31) - Made response categories same as Question 14, with addition of L. and M.

Question 17 (old 32) - Re-organized question structure and substituted "other" for "D. Nothing."

Question 18 (old 33) - Same as 17 above.

Question 19 (old 34) - This question will be directed at all interviewees, and not just those who seem to want a large amount of information. In this way a truer picture of search aid use will be gained. The categories of title listings and abstracts have been combined as in the Phase I analysis. "D. Not necessary for information chunk" has been added to response series.

Question 20 (old 35) - Responses have been re-categorized into a more meaningful series (See Phase I Analysis).

Question 21 (old 36) - See Question 20

(Note: Old 37 dropped from interview - per instructions.)

Question 22 (old 38) - Dropped D as a non-useful category (see Phase I Analysis).

Question 23 (old 39) - See Question 22.

Questions 24 and 25 (old 40 and 41) - Added a set of responses which reflect oral transmission and previous experience.

Question 26 (old 42) - Made all responses active. Added items (F, H, J, K, and M) to reflect industrial population.

Question 27 (old 43) - Basically no change.

Question 28 (old 44) - Rephrased to clarify and added some example responses.

Question 29 (old 45) - Reorganized question structure and added "D. Irrelevant or inappropriate information" to responses.

Question 30 (old 46) - Clarified A and B as misunderstood in Phase I.

Question 31 (old 47) - Broke "A. Directly in Task" into subsets A, B, and C to give responses more clarity and depth. Items can be regrouped if desired for a comparison with Phase I results.

Question 32 (old 48) - Same as Phase I.

Part II (old Part III)

Questions 33 through 36 are new items to gain data on company information and data centers (per W. Carlson).

Question 37 (old 49) - Same as Phase I.

Question 38 - New question to query knowledge about STAR.

Question 39 (old 50, 51) - Combined old questions 50 and 51 into one composite, meaningful response series. Items B, C, and D derived from Phase I Analysis and narrative comments.

Question 40 (old 52, 53) - See Question 39.

Question 41 - New question to find if special centers other than those on the list are utilized.

Question 42 (old 54, 55) - Combined old questions 54 and 55. Added query as to language of original.

Part III (old Part IV)

Same as Phase I. Old questions 1, 2, 3 have been renumbered 43, 44, and 45 respectively.

Part IV (old Part I)

Questions 46 and 47 (old 2 and 3) - Same as Phase I.

Question 48 (old 4 and 5) - Asks for field and year for each degree obtained.

Question 49 (old 8) - Same as Phase I.

Question 50 - New question to establish relationship of the chance to be familiar with company procedures and information acquisition/need of an individual.

Question 51 (old 6 and 7) - Same as Phase I.

Question 52 and 53 (old 9 and 10) - Have been expanded to cover industrial population.

Question 54 - The narrative description of the respondent's job as in Phase I.

Question 55 (old 1) - To be used to establish comparable sets between Phase I and II.

Part V (old Part V)

Questions 56 and 57 (old 59, 60) - Eliminated STINFO, per instructions.

Questions 58, 59 and 60 (old 93) - Taken from old page 3a of Guide and placed with other subjective comments. Structure of questions changed.

APPENDIX 3. EXPLANATORY NOTES TO 26 JULY EDITION OF PHASE II INTERVIEW GUIDE

These notes reflect the discussion regarding the draft Interview Guide Modification held in Washington, D.C., 8 July 1965. The Interview Guide, SID 65-1041-2, 26 July edition is based on the results of these discussions.

Question 3 - Expanded to cover more specific kinds of task outputs; e.g., basic and applied research, several aspects of development (advanced, engineering, operational, customer relations, and system analysis).

Question 5 - Added the category "Instructions or questions from customer."

Question 8 - Added "technical data or information" category and clarified "specification" category to include design.

Question 10 - Added "individual's own use" category.

Question 16, 24 - Expanded media to include all those utilized during Phase I.

Question 26 - Reorganized into a more logical order and added category "Requested data from manufacturer, vendor or supplier."

Question 30 - Clarified categories to be more meaningful and mutually exclusive.

Question 34 - Added "Microfilm" category.

Question 35 - Clarified responses.

Question 40 - New list of specialized information centers provided by DOD. Also changed responses to cover the single most often used center only.

Questions 42, 43 - Added questions to elicit response about difficulties in acquiring technical information due to proprietary or security restrictions.

APPENDIX 4. EXPLANATORY NOTES TO MODIFICATION OF 26 JULY EDITION OF PHASE II INTERVIEW GUIDE

On the basis of the analysis of the Pilot Test, the 26 July edition of the Interview Guide, SID 65-1041-2, was reorganized, and numerous clarifying and editorial changes were made. The relationship of the Phase I questions to the Phase II questions is shown in Tables 6 and 7.

Principal changes in the 26 July edition - resulting in the 1 August edition - are indicated below:

Question 3 - Made all elapsed time responses into days to give equivalent categories.

Question 7 - Added NASA as a prime contractor.

Questions 12, 13, 21, 22 - Added "recall" to response categories.

Questions 21, 22, 24, 25 - Made response into a completion type statement.

Question 23 - Clarified response categories.

Question 26, 27 - Made into independent questions.

Question 30 - Changed responses so that they are progressive and indicate degree of essentiality.

Question 31 - Dropped aspect of being "Used Directly" in Task as being superfluous.

Question 34 - Clarified Micro-form and listed examples.

Question 41 - Clarified by adding "other than those listed."

Questions 42 and 43 - Modified to eliminate the "leading question" characteristic and to provide respondent with the opportunity to indicate other problem areas connected with restriction of information.

Question 50 - Reversed position of field and year obtained to clarify question.

Table 6 Sequence of Reordered Questions

New Sequence	Old Sequence
CHUNK INFORMATION	
Time Required	Class
Source	Field
Media	Media
Breath	Breath
Title Listings	Title Listings
Depth	Time
Physical Layout	Depth
Class	Physical Layout
Field	Source
Utilization	Utilization
TASK INFORMATION	
Origination	Field
Time	Kind
Output	Class
Class	Origination
Kind	Time
Field	Output

Table 7 Relationship of Phase I Questions to Phase II Questions

Phase I Guide (Auerbach) May 14, 1965	Phase II Guide NAA, SID 65-1041-2, 1 August 1965
Part I	Part IV
1	58
2	48
3	49
4 Combined	50
5	50
	52 (Years with Company) added
6	53
7	N/A Dropped
8	51
9	54
10	55
11	56
No number	57 (Narrative description of job)

Table 7 Relationship of Phase I Questions to Phase II Questions (Cont)

Phase I Guide (Auerbach) May 14, 1965	Phase II Guide NAA, SID 65-1041-2, 1 August 1965
Part II	Part I
12	1 Narrative
12	10
13	Dropped
14	9
15 Combined	2
16	2
17	3
18	4
19	N/A Dropped
20	5
21 Combined	6
22	6
23	7
94	8
93	61, 62 & 63 (Part V)
24	11
25	28
26	29
27	Dropped
28	18
29 Combined	19
30	19
31	20
32	21
33	22
34	23
35	12
36	13
37	Dropped
38	24
39	25
40	26
41	27
42	14
43	15
44	16
45	17
46	30
47	31
48	32
95	Dropped

Table 7 Relationship of Phase I Questions to Phase II Questions (Cont)

Phase I Guide (Auerbach) May 14, 1965	Phase II Guide NAA, SID 65-1041-2, 1 August 1965
Part III	**Part II**
	33-36 (Company TIC) Added
49	37
	38 (Star) Added
50 } Combined	39
51	39
52 } Combined	40
53	40
	41 (Other Special TIC) Added
	42-43 (Restrictions) Added
54 } Combined	44
55	44
Part IV	**Part III**
56	45
57	46
58	47
Part V	**Part V**
59	59
60	60

APPENDIX 5. INTERVIEW GUIDE

The interview guide is reproduced here in total except for the even numbered pages which were for miscellaneous notes. Page A5-4 is identical to the pages that have been eliminated.

C6-2442/030

Vol II

IID ____________________

Edited By ____________________
(Name) (Date)

Accession No. 07467-65

SID 65-1041-2

DOD USER-NEEDS STUDY - PHASE II

Scientific and Technical Information in the Defense Industry

Interview Guide

1 August 1965

Contract DSA7-16244
Office of Defense Research and Engineering
Advanced Research Projects Agency

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

☐☐☐☐ Accession Number

Date of Interview__________ 1965

☐ 1

☐☐ Interviewer's Number

Interview Began

_______A. M._______P. M.

☐☐☐ Minutes Interview Lasted

Interview Ended

_______A. M._______P. M.

PART I: ANALYSIS OF TASK INFORMATION

(Note to Interviewer: The following questions concern some recent task that included technical considerations. If the respondent has done nothing recently or if the task lasted significantly less than eight hours, or if there were no technical considerations in the task, then work back in time until the respondent identifies a concluded task that satisfies the task criteria.)

1. Can you describe the most recent technical task you have COMPLETED? (Criteria: 8 or more Task hours, technical data involved, and a definable output.)______________________________

____

____

____

____

2. What prompted the task?

☐

1 Instruction or questions directed from the customer
2 Direction by higher management
3 Direction by immediate supervisor
4 Initiative of respondent
5 Decision by respondent and colleagues
6 Application of standard procedures
7 Some combination of the above (Specify)______________________________

____

____

8 None of the above (Explain)______________________________

3. What was the TOTAL ELAPSED TIME that you were active on this task, from the time you started it until the time you finished it, including periods during which you may have been diverted to other activities?

☐

1 Less than 1 day
2 1 day
3 2 days
4 3 days
5 4-7 days
6 8-14 days
7 15-21 days
8 22-28 days
9 More than 28 days (Specify) ____________________

4. During the total elapsed time that you were active on this task, about what percentage of your work time did you devote directly to the task?

☐

1 Under 25%
2 25-49%
3 50-74%
4 75-99%
5 Full time

5. What was the major output of the task?

☐

1 Technical data or information
2 A finding
3 A recommendation
4 A decision
5 A plan
6 A design (includes specifications)
7 Hardware
8 Other (Specify) ____________________

6. How was the major output of the task presented or transmitted?

☐

1 Formal document
2 Formal briefing or demonstration
3 Informal document or memorandum
4 Informal briefing or discussion
5 Some combination of the above (Specify) ____________________

____

6 Other (Specify) ____________________

7. To whom was the major output of the task directed?

☐

1 Individual's own use
2 Individual(s) within the respondent's company
3 Members of the respondent's profession
4 A major segment of an industry
5 A particular contractor or contractors
6 Department of Defense
7 NASA
8 Some combination of the above (Specify)______________________

____

9 Other (Specify)______________________________

____

8. What was the CLASS (as defined on page 3 of the Interview Reference Manual) of the major output of the task?

☐☐ 14 Other (Specify)______________________________

____

9. What was the KIND (as defined on page 4 of the Interview Reference Manual) of the major output of the task?

☐☐ 13 Other (Specify)______________________________

____

10. What was the FIELD (as defined on page 5 of the Interview Reference Manual) of the major output of the task?

☐☐ 35 Other (Specify______________________________

____

(Note to Interviewer: In the following sequence of questions, enumerate and discuss all information chunks that relate to the previously mentioned task. Record them narratively. Explain to the respondent that you will then ask a series of questions about how he obtained information, and what information he used on each of these chunks.)

11. Now I am going to focus my questions on all the chunks of information you used to accomplish this task. What are these chunks? Would you describe each of them to me? (Obtain at least two information chunks)

    (a) Which, if any, of these information chunks did you get with this task assignment?

    (b) Did any information chunks come to you informally—that is, information you may have received orally from a colleague, a phone call, etc.?

    (c) Was there any information you obtained during the task that you never used by the end of the task?

    (d) Was there any information you wanted at the beginning or during the task that was not obtained by the end of the task?

    (e) Can you recall any other information chunks that helped you in this task?

    (f) WOULD YOU RANK THEM IN THEIR ORDER OF IMPORTANCE (if appropriate)?

I ______________________________

____

II ______________________________

____

III ______________________________

____

IV ______________________________

____

V ______________________________

____

12. How much time ELAPSED from the time you requested this chunk of information—or from the time you started to search for it—until you got it?

I	II	III	IV	V
☐	☐	☐	☐	☐

1 From recall
2 Less than 1 day
3 1-7 days
4 8-30 days
5 More than 30 days
6 Not applicable (Explain)

I ______________________________

II ______________________________

III ______________________________

IV ______________________________

V ______________________________

13. From the time you requested this chunk or started to search for it, was there a maximum ELAPSED time you could have allowed to get it?

I	II	III	IV	V
☐	☐	☐	☐	☐

1 From recall
2 Less than 1 day
3 1-7 days
4 8-30 days
5 More than 30 days
6 Not applicable (Explain)

I ______________________________

II ______________________________

III ______________________________

IV ______________________________

V ______________________________

14. How did you FIRST go about getting this information chunk?

I	II	III	IV	V
☐☐	☐☐	☐☐	☐☐	☐☐

01 Received with task assignment
02 Asked my supervisor
03 Assigned subordinate to get it
04 Recalled it
05 Asked a colleague
06 Asked an internal company consultant
07 Requested library search
08 Requested search of departmental files
09 Searched own collection
10 Searched company information/data center
11 Searched outside library
12 Searched DOD information/data center
13 Requested search of DOD information/data center
14 Searched manufacturer, vendor, or supplier sources
15 Requested data from manufacturer, vendor, or supplier
16 Other (Specify)

I ______________________________

II ______________________________

III ______________________________

IV ______________________________

V ______________________________

15. What is the main reason that you used this source FIRST?

I	II	III	IV	V
☐	☐	☐	☐	☐

1 Received with task assignment
2 Only source known
3 Most authoritative
4 Available, handy, or easy to use
5 Recalled, or was told, that specific chunk was available from the source
6 Found helpful previously
7 Other (Specify)

I ______________________________

II ______________________________

III ______________________________

IV ______________________________

V ______________________________

16. What question(s) did you want answered by this FIRST source?

(Interviewer: Example responses to this question could be: (1) What is a good source for data on ______? What is the the temperature range of a ______? (3) Do you have the book on ______? (4) What is the location of ______?)

I ____

____

II ____

____

III ____

____

IV ____

____

V ____

____

17. What did you get from this FIRST source?

I	II	III	IV	V
☐	☐	☐	☐	☐

1 All the information needed
2 Part of the information
3 Reference to another source
4 Irrelevant or inappropriate information
5 Nothing

\(END OF CARD 1)/

18. Would you describe the media (as defined on page 6 of the Interview Reference Manual) by which you received this information chunk?

/BEGIN CARD 2 (COL. 6)\

Note: If more than one medium was used, indicate the three most important, in order of importance (i. e., 1, 2, 3).

	I	II	III	IV	V
(1)	☐☐	☐☐	☐☐	☐☐	☐☐
(2)	☐☐	☐☐	☐☐	☐☐	☐☐
(3)	☐☐	☐☐	☐☐	☐☐	☐☐

28 Other (Specify)

I ______________________________

II ______________________________

III ______________________________

IV ______________________________

V ______________________________

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19. What media do you use regularly to obtain this information chunk?

I	II	III	IV	V
☐	☐	☐	☐	☐

1 Same as those indicated in question 18

2 Same as those indicated in question 18 and other media (Specify):

I ____________________

II ____________________

III ____________________

IV ____________________

V ____________________

3 None indicated in question 18, but use these others (Specify):

I ____________________

II ____________________

III ____________________

IV ____________________

V ____________________

20. At the time you obtained this information chunk, would you rather have had it presented by any other medium (as defined on page 6 of the Interview Reference Manual)? If more than one medium is indicated, record the three most important, in order of importance (i. e., 1, 2, 3).

	I	II	III	IV	V
(1)	☐☐	☐☐	☐☐	☐☐	☐☐
(2)	☐☐	☐☐	☐☐	☐☐	☐☐
(3)	☐☐	☐☐	☐☐	☐☐	☐☐

28 Other (Specify)

I ____________________

II ____________________

III ____________________

IV ____________________

V ____________________

29 No

30 No preference

\(END CARD 2)/

21. When you received this chunk of information, did you GET:

BEGIN CARD 3 (COL 6)

I	II	III	IV	V
☐	☐	☐	☐	☐

1 One report or document?
2 A sampling of the reports and documents available?
3 All reports and documents that could be found pertinent to the question?
4 All from recall
5 Other (Specify)

I ____________________

II ____________________

III ____________________

IV ____________________

V ____________________

22. For each information chunk, did you WANT:

I	II	III	IV	V
☐	☐	☐	☐	☐

1 One report or document?
2 A sampling of the reports and documents available?
3 All the reports and documents that could be found pertinent to the question?
4 All from recall
5 Other (Specify)

I ____________________

II ____________________

III ____________________

IV ____________________

V ____________________

23. Would you comment on the usefulness of title listings or abstracts with regard to this chunk?

I	II	III	IV	V
☐	☐	☐	☐	☐

1 Used them for this chunk
2 Would have found them useful
3 Would not have been useful (Explain)

I ____________________
II ____________________
III ____________________
IV ____________________
V ____________________

24. For this information chunk did you GET:

I	II	III	IV	V
☐	☐	☐	☐	☐

1 A once over lightly?
2 A detailed analysis?
3 A specific answer?

25. At the time you recognized the need for this information chunk, did you WANT:

I	II	III	IV	V
☐	☐	☐	☐	☐

1 A once over lightly?
2 A detailed analysis?
3 A specific answer?

26. What was the physical layout (as defined on page 7 of the Interview Reference Manual) of this chunk of information when you RECEIVED it?

I	II	III	IV	V
☐☐	☐☐	☐☐	☐☐	☐☐

15 Other (Specify)

I ____________________
II ____________________
III ____________________
IV ____________________
V ____________________

27. In what physical layout (as defined on page 7 of the Interview Reference Manual) would you have WANTED it?

I	II	III	IV	V
☐☐	☐☐	☐☐	☐☐	☐☐

15 Other (Specify)

I ____________________

II ____________________

III ____________________

IV ____________________

V ____________________

28. What was the CLASS (as defined on page 3 of the Interview Reference Manual) of this chunk?

I	II	III	IV	V
☐☐	☐☐	☐☐	☐☐	☐☐

14 Other (Specify)

I ____________________

II ____________________

III ____________________

IV ____________________

V ____________________

29. What was the FIELD (as defined on page 5 of the Interview Reference Manual) of this chunk?

I	II	III	IV	V
☐☐	☐☐	☐☐	☐☐	☐☐

35 Other (Specify)

I ____________________

II ____________________

III ____________________

IV ____________________

V ____________________

30. How essential was this information chunk to the task?

I	II	III	IV	V
☐	☐	☐	☐	☐

1 Absolutely essential to successful task completion.
2 Not essential, but extremely helpful to successful task completion.
3 Not essential, but somewhat helpful to successful task completion.
4 Neither essential nor helpful to successful task completion.

END OF CARD 3

31. To what extent was this information chunk used in the task?

BEGIN CARD 4 (COL. 6)

I	II	III	IV	V
☐	☐	☐	☐	☐

1 Throughout the entire duration of the task
2 In major portions of the task
3 In only small parts of the task
4 As background information
5 As a lead to other information
6 Not at all
7 Other (Specify)

I ______________________________

II ______________________________

III ______________________________

IV ______________________________

V ______________________________

NOTE TO INTERVIEWER: RETURN TO QUESTION 12, PAGE 9, AND REPEAT THE SAME QUESTIONS FOR EACH INFORMATION CHUNK.

32. After you finished the total TASK, did you learn of any relevant information that was available but unknown to you while you were doing the task?

☐

1 Yes (Explain) ______________________________

____

2 No

PART II: UTILIZATION OF INFORMATION CENTERS

33. Does your company have a technical information center or similar library facility?

☐

1 Yes
2 No (Interviewer: Skip to Question 37)
3 Not sure (Interviewer: Skip to Question 37)

34. What services, facilities, and documents does your company information center have?

☐☐ ☐☐ ☐☐ ☐☐ ☐☐
☐☐ ☐☐ ☐☐ ☐☐ ☐☐

01 Bibliography service
02 Abstract service
03 Acquisition lists
04 Awareness/special interest service/SDI
05 Information retrieval (search) service
06 Films and projection service
07 Library telephone checkout service
08 Micro-form and associated reader-printer services (e.g., microfilm, microfiche, aperture cards, etc.)

09 Other (Specify) ______________

____

10 Not familiar with company information center

35. How often do you use your company information center?

☐

1 Regularly-frequently (twice or more a month)
2 Regularly-infrequently (once a month)
3 Only on an as-needed basis
4 Never

36. How would you categorize or describe your company information center as to its satisfaction of your information/data needs?

☐

1 Almost always find needed information
2 Seldom get what is needed
3 Center is too far from my work location
4 Takes too long to get available information
5 Never use the information center
6 Other (Specify) ____________________

____

37. How often do you see or read TAB (Technical Abstract Bulletin)?

☐

1 Every issue or almost every issue
2 Once every 2 or 3 months
3 About once every 6 months
4 Never
5 Do not know of TAB

38. How often do you see or read STAR (Scientific & Technical Aerospace Reports)?

☐

1 Every issue or almost every issue
2 Once every 2 or 3 months
3 About once every 6 months
4 Never
5 Do not know of STAR

39. Do you use DDC (Defense Documentation Center) (ASTIA)?

☐

1 Yes, including own library going to DDC (For what kinds of information?) ____________________

____

2 Know of DDC, but do not use it
3 Do not know of DDC
4 Not relevant
5 Use other sources instead
6 Other (Specify) ____________________

____

40. (Note to Interviewer: Show respondent list on pages 8, 9, and 10 of Reference Manual.) Of the DOD specialized information and data centers shown on this list, which one do you use most often?

☐☐ Enter number of the center, from list

Or:

29 Do not know of such centers

30 Not relevant

31 Use other sources instead

32 Other (Specify) ____________________

____

41. Do you use any specialized information and/or data centers other than those listed?

☐ 1 Yes (which ones?) ____________________

____

2 No

42. Have you encountered any special restrictions which made it difficult to obtain information needed in your work?

☐ 1 Yes (Go to Question 43)

2 No (Skip to Question 45)

43. What was the nature of the restriction(s)?

☐ 1 Proprietary (Explain) ______________________________

____

____

2 Industrial (Governmental) Security (Explain) ______________

____

____

3 Both 1 & 2 (Explain - examples of each) ______________

____

____

____

____

4 Other (Explain) ______________________________

____

____

____

44. Do you use English translations or English abstracts of foreign literature?

☐ 1 Yes (Name usual source and language) ______________

____

____

2 No

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PART III: GENERAL INFORMATION PATTERNS

45. With respect to all the tasks you have worked on over the last year, did you have any difficulty obtaining or locating technical information needed to perform or complete these tasks?

☐

1 Yes (Go to questions 46 and 47)
2 No (Go to Part IV)

46. Would you explain the difficulty?

47. Can you offer a possible solution to the problem?

PART IV: RESPONDENT PROFILE

48. In what year were you born?

☐☐

49. How many technical personnel do you supervise?

☐☐☐

50. What college degrees do you hold? In what field? When did you get each?

Highest Degree	Year Obtained	Field
☐	☐☐	▨▨

	Year Obtained	Field
1 Associate's	__________	________
2 Bachelor's	__________	________
3 Master's	__________	________
4 Professional (Ed. D., L. L. B., Engr)	__________	________
5 Doctor's	__________	________
6 None		

51. About how long have you been doing your present kind of work?

☐☐☐ Months

52. About how long have you been associated with this company?

☐☐☐ Months

53. What is your present job title? ____________________________

54. In what TYPE of activity are you primarily engaged?

☐

1 Administrative management
2 Technical management
3 Both administrative and technical management
4 Scientific and engineering (Nonmanagement)
5 Technical evaluation
6 Other (Specify) ____________________________

55. What KIND (as defined on page 4 of the Interview Reference Manual) of work do you do? (Most descriptive)

☐☐ 13 Other (Specify) ________________________________

____

56. What is the FIELD (as defined on page 5 of the Interview Reference Manual) of your work?

☐☐ 35 Other (Specify) ________________________________

____

57. Narrative description of respondent's job:

____

____

____

____

____

____

____

____

____

58. What is your equivalent GS rating (as defined on page 11 of the Interview Reference Manual)? (This information is necessary to correlate with Phase I results.)

☐☐

END OF INTERVIEW

PART V: SUBJECTIVE COMMENTS

The following section should be filled out immediately after the conclusion of the interview, but not in the presence of the interviewee.

59. How would you characterize the respondent's need for external scientific and technical information and data?

☐

1 Large need
2 Moderate need
3 Insignificant need

60. Any other opinions of respondent's technical information and data patterns?

____

____

____

____

____

____

61. At the beginning of the task described in response to Question 1, was the choice of method or procedure for using the needed information:

☐

1 Obvious or prescribed?
2 Entirely or largely independent of professional judgment?
3 Entirely or largely dependent upon professional judgment?
4 Difficult, because methods and procedures were lacking?

62. When the respondent started the task described in response to Question 1, was a suitable method or procedure of obtaining needed information:

☐

1 Quite clear or obvious?
2 Fairly clear or obvious?
3 Neither clear nor obvious?

63. Would you consider the output of the task—

☐

1 Communication of existing information?
2 Rearrangement of existing information, with little evaluation or analysis?
3 Extensive evaluation and analysis of existing data?
4 Creation of new information, systems, or hardware?

END OF CARD 4

APPENDIX 6. REFERENCE MANUAL AND CODE TABLES

INDEX

APPENDIX 6. REFERENCE MANUAL AND CODE TABLES

I. DEGREE FIELD CLASSIFICATION*

00	No Degree
01	Arts - Humanities (See 40-49)
02	Biology
03	Chemistry
04	Mathematics and Statistics
05	Physics
06	Psychology
07	General Engineering (e.g. Engineering Science, Engineering Management, Senior Engineering, and Engineering Mechanics)
08	Aerospace Engineering (Including Aeronautics and Astronautics)
09	Chemical Engineering
10	Civil Engineering (Also Naval Architecture)
11	Electrical Engineering (Also Electronics, and Communications)
12	Industrial Engineering
13	Mechanical Engineering (Also Applied Mechanics, Marine Engineers, and Engineering Mechanics)
14	Metallurgical Engineering (Also Metallurgy, Mining Engineering)
15	Military Science
16	Sciences - Other and Misc. (e.g. General Science, Applied Science) (See 30-39)
17	Business and Business Administration
18	Engineering Science

Engineering - Other

20	Aeronautical Engineering (Astrodynamics)
21	Maintenance Engineering
22	Petroleum Engineering
23	Ceramic Engineering
24	Systems Engineering
25	Automotive Engineer
26	Architectural Engineer
27	Agricultural Engineer

---

*This code table is used for question 50C.

Sciences - Other

30 Aeronautics
31 Physiology
32 Meteorology and Astronomy
33 Geology and Minerology
34 Agriculture and Agronomy
35 Pharmacy
36 Geophysics
37 Dentistry
38 Zoology
39 Medical Sciences
  Psychiatrists
  Public Health
  All Md's

Arts - Humanities

40 Economics
41 Education
42 Political Science and I.R.
43 Law
44 History
45 Geography
46 Sociology

01 - Arts

Journalism -
Languages -
English -
Philosophy -

Persons with two equivalent level degrees obtained in the same year will be classified by the degree field most compatible with his job description.

Persons with two equivalent level degrees obtained in different years will be classified by the earliest degree and year unless it is not compatible with his job description.

II. CLASSES OF INFORMATION CONTENT*

01 Concepts
02 Cost and funding; administrative action
03 Designs or design techniques
04 Experimental processes and procedures
05 Math aids and formulae; computer programs
06 Performance and characteristics

*This code table is used for questions 8 and 28.

07	Production processes and procedures
08	Raw data
09	Specifications
10	Technical status
11	Test processes and procedures
12	Utilization
13	Evaluation
14	Other (specity)

III. KINDS OF FUNCTIONAL EFFORT*

01	Research - applied
02	Research - basic
03	Development - advanced
04	Development - engineering
05	Development - operational system
06	R&D support
07	Test or evaluation
08	Production processes
09	Production end-items
10	Reliability or quality control
11	System analysis
12	Customer relations
13	Other (specify)

IV. SUBJECT FIELD**

01	Aircraft and flight equipment
02	Astronomy, geophysics, and geography
03	Chemical warfare equipment and materials
04	Chemistry

---

*This code table is used for questions 9 and 55

**With one exception these codes are based upon the definitions used by the Defense Documentation Center and published in DDC Distribution Guide (Alexander, Virginia: Defense Documentation Center, Defense Supply Agency) Reprint January 1965. The above codes include the addition of code 34 which was segregated from code 30, but the area of (34) computer programming, operations were re-combined with (30) Research and Research Equipment for the analysis. This code table is used for questions 10 and 29

05	Communications
06	Detection
07	Electrical equipment
08	Electronics, electronic equipment
09	Fluid mechanics
10	Fuels and combustion
11	Ground transportation equipment
12	Guided missiles
13	Installations and constructions
14	Materials (nonmetallic)
15	Mathematics
16	Medical sciences
17	Metallurgy
18	Military sciences and operations
19	Navigation
20	Nuclear physics and nuclear chemistry
21	Nuclear propulsion
22	Ordnance
23	Personnel and training
24	Photography and other reproduction processes
25	Physics
26	Production and management
27	Propulsion systems
28	Psychology and human engineering
29	Quartermaster equipment and supplies
30	Research and research equipment
31	Ships and marine equipment
32	Miscellaneous arts and sciences
33	Transportation
34	Computer programming, operations
35	Other (specify)

V. MEDIA*

01	Brochures
02	Catalogs

---

*This code table is used for questions 18 and 20.

03	Standards and codes
04	Drawings and schematics
05	Parts lists
06	System specification document (QMR, TDP, etc.)
07	Oral contacts with manufacturer
08	Oral contacts - all other
09	Meetings and symposia
10	Directives
11	Correspondence, memos, and TWX
12	Handbooks
13	Manuals
14	Newsletters and other mass madia
15	Live demonstrations
16	Preprints and reprints
17	Proposals
18	Reports
19	Textbooks
20	Photographs, maps, and films
21	Journals
22	Previous knowledge
23	Computer printout
24	Personal notes, personal logs, and personal files
25	Physical measurement or experiment
26	Microfilm or microfiche
27	Slides or motion pictures
28	Other (specify)

VI. PHYSICAL LAYOUT (OF INFORMATION)*

01	Narrative text
02	Tables or lists
03	Graphics (diagrams, drawings, schematics, flow chart, graphs, maps)
04	Photographs
05	Microfilm-microfiche
06	Slides or motion pictures

---

*This code table is used for questions 26 and 27.

07 Graphics and text
08 Photographs and text
09 Graphics and lists
10 Formal briefing or lecture
11 Group discussion
12 Informal briefing, with chalk or pencil drawings
13 Telephone conversation
14 Recall
15 Other (specify)

VII. DEPARTMENT OF DEFENSE INFORMATION ANALYSIS CENTERS*

Chemistry and Chemical Sciencies

01 CHEMICAL PROPULSION INFORMATION AGENCY
The Applied Physics Laboratory
The Johns Hopkins University

Physics and Physical Sciences

02 DASA DATA CENTER
TEMPO, General Electric Co.

03 INFRARED INFORMATION AND ANALYSIS CENTER
University of Michigan

Earth and Related Sciences

04 NATIONAL OCEANOGRAPHIC DATA CENTER
Washington, D. C.

05 VELA SEISMIC INFORMATION ANALYSIS CENTER (VESIAC)
University of Michigan

Biological Sciences

06 HIBERNATION INFORMATION EXCHANGE
Office of Naval Research

07 MILITARY ENTOMOLOGY INFORMATION SERVICE
Walter Reed Army Medical Center

---

*This code table is used for question 40.

Human Engineering

08 HUMAN ENGINEERING INFORMATION AND
ANALYSIS SERVICE
Tufts University

Materials and Related Sciences

09 BINARY INFORMATION SERVICE
I. T. T. Research Institute

10 CERAMICS AND GRAPHITE
INFORMATION CENTER
Air Force Materials Laboratory

11 DEFENSE METALS INFORMATION CENTER
Battelle Memorial Institue

12 ELECTRONIC PROPERTIES INFORMATION CENTER
Hughes Aircraft Company

13 MECHANICAL PROPERTIES DATA CENTER
Belfour Engineering Company

14 PLASTICS TECHNICAL EVALUATION CENTER (PLASTEC)
Picatinny Arsenal

15 RADIATION EFFECTS INFORMATION CENTER
Battelle Memorial Institute

16 THERMOPHYSICAL PROPERTIES RESEARCH CENTER
Purdue University

Engineering Sciences

17 SHOCK AND VIBRATION INFORMATION CENTER
U. S. Naval Research Laboratory

18 NONDESTRUCTIVE TESTING INFORMATION ANALYSIS CENTER
Army Materials Research Agency

Mission-Oriented

19 BALLISTIC MISSILE RADIATION CENTER (BAMIRAC)
University of Michigan

20 BATTELLE-DEFENDER INFORMATION ANALYSIS CENTER (BDIAC)
Battelle Memorial Institute

21 COUNTERINSURGENCY INFORMATION ANALYSIS CENTER (CINFAC)
American University

22 REMOTE AREA CONFLICT INFORMATION CENTER (RACIC)
Battelle Memorial Institute

23 DEFENSE LOGISTICS STUDIES INFORMATION EXCHANGE

24 INTERSERVICES DATA EXCHANGE PROGRAM (IDEP)

25 INDEX OF SPECIFICATIONS AND STANDARDS (DODISS)

26 SECRETARIAT FOR ELECTRONIC TEST EQUIPMENT (SETE)

27 ADVISORY GROUP FOR ELECTRON DEVICES (AGED)

28 PARTS RELIABILITY INFORMATION CENTER (PRINCE)

VIII. GS RATING EQUIVALENCY*

01	GS-6	(under 6,000)
02	GS-9	(6,000 - 8,000)
03	GS-11	(8,000 - 10,250)
04	GS-12	(10,250 - 12,000)
05	GS-13	(12,000 - 14,000)
06	GS-14	(14,000 - 16,500)
07	GS-15	(16,500 - 19,000)
08	GS-16	(19,000 - 21,000)
09	GS-17	(21,000 - 24,000)
10	GS-18	(24,000 - 27,000)
11	Sp A	(27,000 - 30,000)
12	Sp B	(30,000 - 35,000)
13	Sp C	(over 35,000)

IX. PRESENT JOB CLASSIFICATION**

United States Civil Service Commission Handbook X-118 entitled "Qualification Standards for Classification Act Positions" was used to classify the job positions. codes and job positions utilized were:

MOS	Description
0015	Operations Research
0101	Social Science
0110	Economist
0131	International Relations

---

*This code table is used for question 58.

**This code table is used to classify question 53 and is identified in the computer records as MOS (Military Occupation Specification).

MOS	Description
0132	Intelligence
0170	History
0180	Psychology
0201	Personnel Administration
0222	Occupational Analysis
0330	Digital Computer Systems Administration
0331	Digital Computer Programming
0332	Digital Computer Systems Operation
0333	Peripheral Computer Equipment Operation
0334	Digital Computer Systems Analysis
0340	Program Management
0341	Administration Assistant and Officer
0393	Communications Specialist
0401	Biology
0403	Microbiology
0413	Physiology
0525	Accounting Technician
0602	Medical Officer
0615	Public Health Nurse
0660	Pharmacist
0680	Dental Officer
0801	General Engineering
0802	Engineering Technician
0803	Safety Engineering
0805	Maintenance
0806	Materials Engineering
0809	Construction Inspection
0810	Civil Engineering
0811	Construction Engineering
0812	Structural Engineering
0818	Engineering Drafting
0830	Mechanical Engineering
0840	Nuclear Engineering
0850	Electrical Engineering
0855	Electronic Engineering

MOS	Description
0856	Electronic Technician
0861	Aerospace Engineering
0870	Marine Engineering
0871	Naval Architecture
0881	Petroleum Production and Natural Gas Engineering
0892	Ceramic Engineering
0893	Chemical Engineering
0896	Industrial Engineering
0897	Valuation Engineering
1001	General Arts and Information
1083	Technical Writing and Editing
1101	General Business and Industry
1102	Contract and Procurement
1103	Industrial Property Administration
1140	Trade Specialist
1150	Industrial Specialist
1152	Production Control
1220	Patent Administration
1222	Patent Attorney
1310	Physics
1311	Physical Science Technician
1313	Geophysics
1320	Chemistry
1321	Metallurgy
1330	Astronomy and Space Science
1340	Meteorology
1350	Geology
1360	Oceanography
1410	Librarian
1520	Mathematics
1529	Mathematical Statistician
1530	Statistician
1701	General Education and Training
1710	Educational and Vocational Training
1712	Instruction

MOS	Description
1720	Educational Research and Program
1901	General Commodities Quality Control and Inspection
1903	Quality Control and Inspection Management
1915	Chemical Quality Control and Inspection
1920	Materials Quality Control and Inspection
1936	Electronic Equipment Quality Control and Inspection
1942	Aircraft Quality Control and Inspection
1950	Missile Quality Control and Inspection
1955	Space System Quality Control
1961	Calibration and Measurement Quality Control and Inspection
2090	Publications Supply
2101	General Transportation
2150	Transportation Operations

APPENDIX 7. DOD LETTER

OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301

4 June 1965

Letter From DOD to Participating Companies - Selection of Interviewees

Dear

The Department of Defense has completed its plans for conducting a survey of the information-gathering techniques used by technical personnel in the Defense industry. You have been designated as your organization's point of contact for this study in the enclosed letter, and I am writing to ask that you take certain steps that are necessary to get the survey under way.

A procedure has been adopted to insure that all organizations in the Defense community are treated uniformly and that the results will be directly comparable to the first phase of the survey conducted within the Department of Defense. The procedure is the following:

1. Assemble a list (or deck of cards or tape or other machine-readable format) of the persons in your organization having the following specific characteristics:

    a. They are considered as professional personnel in some scientific or technical field, whether or not they have college degrees, or they have managerial responsibilities for technical activities. (Henceforth, the word "technical" will embrace the full range of scientific, technical, and engineering work).

    b. They are engaged in technical activities (or management thereof) which can be considered to be part of research, development, proposal preparation, customer relations, systems evaluation, design, manufacture, production control, testing and instrumentation, quality assurance, methods improvement, maintenance, and specialized units engaged in preparing, handling, or disseminating technical data and technical documents.

c. At the option of your organization, they shall be drawn only from the personnel actually engaged in Defense work or they may be drawn from the entire technical staff of your organization.

2. Arrange the listing in some orderly system, such as employee number, alphabetic by name of employee, or social security number.

3. Obtain a random sample of your list by selecting every 70th name in the list. The first name should be selected by placing slips numbered one through seventy in a box and withdrawing one slip; the number on the slip will be the location in the list of the first name, and other names will be chosen at intervals of seventy. If your total list contains less than seventy names, please place slips in the box representing the number of people you have and select one as your organization's sample.

4. Tabulate the names, addresses, and telephone numbers of the persons selected in the sample. The names should be grouped according to their physical location and organizational element; for each such group, please indicate the name of a management or personnel official who should be kept informed, in advance, of plans for contacts with the selected sample to arrange interview dates.

5. Notify the individuals selected and their superiors that they will be contacted by our contractor to arrange a mutually satisfactory time for an interview that will last about two hours and will be held sometime during the last half of 1965.

6. Transmit the tabulation of names in Item 4 above to the contractor office listed on the attached sheet. It is essential that this tabulation be in the hands of our contractor at the earliest possible date, if possible before July 1, 1965.

I am looking forward to your assistance in this most important project. Your name has been added to the distribution list for a copy of the final report on the first phase of the study, and this report should provide you with additional insight about the data we are trying to obtain in the broader context of the entire Defense community.

Sincerely yours,

Walter M Carlson

Walter M. Carlson
Director of Technical Information

Enclosures 2

APPENDIX 8. SYNOPSIS OF INTERVIEW TOPICS

Accession No. 07428-65

SID 65-1041-4

DOD USER-NEEDS STUDY - PHASE II

Scientific and Technical Information
in the Defense Industry

Synopsis of Interview Topics

26 July 1965

Contract DSA7-16244
Office of Defense Research and Engineering
Advanced Research Project Agency

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

C6-2442/030

Vol II

INTRODUCTION

The Department of Defense is sponsoring a study to determine how scientists and engineers in the nation's defense industry acquire and use scientific and technical information. The DOD is conducting a series of such "user-needs" studies to enable it to better serve the Government and the scientific and technical community. The study in which you will participate (Phase II) complements a recently completed study (Phase I) to determine how DOD scientists and engineers acquire and use scientific and technical information.

The objective of the study is to characterize the nature of the user of scientific and technical information, the scientific and technical activities in which he is engaged, the sources and availability of the information required, the time allowable for obtaining the required information, and the areas of difficulty in acquiring the information.

As a participant in this study, you will be interviewed to determine your scientific and technical information requirements and utilization patterns. Information that is classified or of a proprietary nature will not be requested by our interviewer, and under no circumstances should such information be discussed or divulged by you.

To acquaint you with the subject matter of this survey, a synopsis of the topics that will be discussed during the interview is enclosed. We ask that you review this material prior to the scheduled interview.

Although the interview is structured as to the response desired, it has no rigid format. The enclosed set of questions is the essence of the questions you will be asked directly or indirectly during the interview. Without the definition of terms and frame of reference provided by the interviewer, many of these questions may not be clear or meaningful to you. This should not be of concern, however, as the enclosed synopsis is only the skeleton of the discussion that will be guided by our interviewer. Therefore, you need not prepare any formal set of answers to these questions.

DOD USER-NEEDS STUDY - PHASE II

SYNOPSIS OF INTERVIEW TOPICS

1. Describe, in general, the most recent technical task completed by you.

2. Describe the major output of the task (e.g., recommendations, plan, design, hardware, etc.).

3. In what form and to whom was the major output of the task presented or transmitted (e.g., briefings to, report to)?

4. What was the field of this major output (e.g., computer programs, guidance systems, mathematics, propulsion systems, etc.)?

5. What was the kind of this major output (e.g., applied research, production process, test or evaluation, etc.)?

6. What was the class of this major output (e.g., concepts, design techniques, experimental process, specifications, etc.)?

7. What was the total elapsed time that you were active in this task? What percentage of your work time did you devote directly to the task?

8. Discuss the information you need to accomplish this task: What information did you get with the task assignment? Did any information come to you informally (that is, information received orally from a colleague, a phone call, etc.)? Was there any information desired at the beginning or during the task but never obtained?

9. Describe the media by which you received information (e.g., reports, journals, technical documents, discussions, etc.).

10. What media do you use regularly to obtain information needed in your work?

11. How did you first seek the required information?

12 Did you use a particular source, or sources, first, and what information did you get from the source(s)?

13. How much time elapsed from the time you sought the information until you actually got it?

14. When you received information for your task, did you get one good report containing all the information, a sampling of the information available, all material that could be found pertinent to the question, or something else?

15. Discuss the depth of the particular information received by you. Did you get a "once over lightly" of the subject a detailed analysis, or a specific answer?

16. Was the particular information: absolutely essential to successful completion of the task; necessary but nct essential; helpful but not really necessary; or unnecessary?

17. Was the information used: directly throughout the entire task; directly in major portions of the task; directly in only small portions of the task; as background information; as a lead to other information or not at all?

18. After you finished the task, did you learn of any relevant information that would have been available while you were doing the task?

19. With respect to all the tasks you have worked on over the last year, did you have any difficulty obtaining or locating technical information needed to perform or complete these tasks?

20. Would you explain the difficulty (if any)?

21. Can you offer a possible solution to the problem (if any)?

22. Describe your utilization of Technical Information Centers and/or libraries connected with your work.

APPENDIX 9. INTERVIEW PROCEDURES

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APPENDIX 9. INTERVIEW PROCEDURES

I. PRIOR TO TRIP

A. Obtain Interview Packet Containing:

1. Monthly calendar(s) of scheduled interviews
2. Interview schedule lists, by company (Temporary Form ADM 390), and Itinerary
3. Previous correspondence for each interviewee of the trip
4. List of alternates with appropriate information
5. Interview guides for each interviewee plus spares
6. Interview Guide Handbook plus Reference Manual
7. Envelopes for mailing completed interview guides to Downey
8. One copy each of TAB and STAR

B. Make Arrangements for Travel and Obtain Travel Packet Containing:

1. Travel ticket
2. Travel advance
3. Travel forms and instructions
4. Envelopes for mailing Travel Expense Report to Downey.
5. Visit Notification (Security Clearance)

C. Note on Status Board your address and phone during the trip, and expected return date.

D. Check file of companies to be visited on the trip to acquire background information. If you have any questions, consult with the field liaison officer.

E. Verify arrangements with company coordinator.

II. AT TRIP DESTINATION

A. If required, phone the coordinator of the interview-company and/or phone each of the interviewees to confirm the time and place of each interview. Request coordinator to select alternates in case primary interviewee(s) is (are) not available. Make every effort to avoid cancellations since they will reduce the total number of interviewees and adversely affect the sample.

B. Every Friday, call the Downey office collect at area code 213, phone 923-8111, extensions 4505 or 4350, preferably after the last interview of the day, but no later than 4:30 P.M., Pacific Time. Be prepared to state the total number of interviews made during the week and the average elapsed time for those interviews.

Exceptions:

1. You will be traveling back to Downey on Friday and will be at the Downey office on Monday.
2. You did not work a standard 40-hour week and, therefore, called into Downey on Friday between 8:30 and 11:45 A.M., Pacific Time, to state what hours should be charged on your timecard. At the same time, you should be prepared to state an estimated total number of interviews for the week and an estimated average elapsed time per interview.

C. Whenever any serious problem requires immediate attention, call the above Downey number collect.

D. If time permits at the end of each interview, complete and edit that interview guide. Otherwise, do so at the first opportunity, but certainly before the end of the day. Editing includes underlining key words in narrative answers. In addition, you will note any problems or difficulties with the interview or questions of the interview (see #3 above).

E. Complete required "Interview Information" entries on Temporary Form ADM 390; i.e., date and elapsed time of interview. Also indicate reason for substitution by appropriate code or give full explanation for cancellations.

F. At the end of each three-day period, mail to Downey all completed, edited interview guides and your notes on problems and difficulties with interviews or questions of the interview. Handcarry completed interview guides to Downey wherever possible, so long as their arrival at Downey is not delayed more than five days from the date of the earliest interviews in the batch.

G. Each Saturday, mail your weekly Travel Expense Report to Downey.

III. UPON RETURN TO DOWNEY

A. Complete your Travel Expense Report immediately.

B. Arrange for debriefing session.

C. Turn in your completed Interview Schedule Forms (Temporary Form ADM 390).

APPENDIX 10. TYPICAL TRAVEL PLAN

INTERVIEWER: RICHARD LEES
INR: 88
LOCATIONS: MASSACHUSETTS, RHODE ISLAND

Date	Time	Location
8-16-54		Fly to Boston, Massachusetts. Rent Car. Stay in Boston or Cambridge. (Distance Boston to Cambridge: 2 miles)
8-17	8:30 a.m. to 10:30 a.m.	Management Systems Corporation, One Story Street, Cambridge 38, Mass. Contact: R. H. Brady - Vice President 1 Interview
	11:00 a.m. to 5:00 p.m.	(Drive to Waltham, Mass., 5 miles) Raytheon Company, Microwave & Power Tube Div. 100 Willow Street, Waltham, Mass. 2 Interviews (Call Mary J. Keane in Lexington)
8-18 thru 8-19	8:30 a.m. to 5:00 p.m.	Raytheon Company, 130 Second Ave., Waltham, 6 Interviews
8-20	8:30 a.m. to 2:00 p.m.	Raytheon Company, Same Address, 2 Interviews
	3:00 p.m. to 5:00 p.m.	(Drive to Wayland, Mass., 6 miles) Raytheon Company, Wayland, 1 Interview
Aug. 21 - 22		WEEKEND
8-23 thru 8-25	8:30 a.m. to 5:00 p.m. Daily	Raytheon Company, Wayland, Mass. (See Address and Contacts on Raytheon letter) 9 interviews
8-26	8:30 a.m. to 10:30 a.m.	Raytheon Company, Wayland, 1 Interview

Date	Time	Location
	11:00 a.m. to 5:00 p.m.	(Drive to Sudbury, Mass., (3 miles)) Raytheon Company, Sudbury, 2 Interviews (See Address and Contacts on Raytheon letter)
8-27	8:30 a.m. to 10:30 a.m.	Raytheon, Sudbury, Mass. 1 Interview
	3:00 p.m. to 5:00 p.m.	(Drive to Quincy, Mass., 25 miles) Raytheon Co., Quincy, Mass. 1 Interview (See Raytheon letter) (Drive to Braintree, Mass., 3 miles)
Aug. 28 - 29		WEEKEND
8-30	8:30 a.m. to 2:00 p.m.	Hazeltine Co., Braintree, Mass., 2 Interviews (See Letter)
	8:30 a.m. to 5:00 p.m.	(Drive to Newport, R.I., 70 miles) Raytheon, 3 Interviews (See Raytheon letter)
Sept. 1		(RETURN TO LOS ANGELES)

APPENDIX 11. CONTROL OFFICE AND EDIT CONTROL PROCEDURES
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APPENDIX 11. CONTROL OFFICE AND EDIT CONTROL PROCEDURES

I. WHEN COMPLETED INTERVIEW GUIDES ARE RECEIVED:

A. Enter Accession Number (Interview Identification Number).

B. Check to see that "Minutes Interview Lasted" (on page 1) agrees with differences of time shown on its right.

C. Check to see that "Date of Interview" and "Minutes Interview Lasted" shown on Page 1 of the Interview Guide agree with "Completion Date" and "Completion Time for that interview on the Interview Schedule (Temporary Form ADM 390). If so, place a red check to the left of that interviewee on the Temporary Form ADM 390.

D. For interviews that have been cancelled or are from nonqualified interviewees, mark them as Cancelled or NQ on the "Status of Individual Interviews" sheet and put a single horizontal line through the red check mark.

E. Tally all other interviews for that "Status of Interviews by Company" sheet, mark each of them as being completed (C) on the "Status of Individual Interviews" sheet, and put a double horizontal line through the red check mark.

II. AT THE END OF EACH WEEK

A. Check to see that each name on the Temporary Form ADM 390 for that week (Monday through Friday) has a red check next to it. If not, efforts must be made to find out whether it has been rescheduled, or what its status is.

B. Enter all times for each interviewer on the weekly "Interview Time Statistics" and process that week's "Interview Time Statistics."

III. GENERAL EDIT OF EACH INTERVIEW GUIDE

A. Upon return from his first trip, each interviewer will edit approximately 20 Interview Guides and, when finished with each, place his number above "Name" on the cover sheet.

B. The editor will note serious deficiencies and refer them to the original interviewer. Obvious mistakes or omissions can be filled in or corrected by the editor (in a color different from that used by the original interviewer—preferably red).

C. The editor will note any additional editing procedures required and turn them over to the project secretary to be evaluated for incorporation into existing edit and control procedures.

D. With the following exceptions, the set of boxes for each question must have a digit in it.

1. Questions 12 through 31: Boxes will be blanks for noninvestigated chunks.

2. Questions 18 and 20: Only the first line must have digits for investigated chunks. Blanks or digits may appear in the second or third line.

3. Question 34: Double blanks will appear in the corresponding pair of boxes for those services, etc., that the interviewee felt the company information center did not have.

4. Questions 34, 35, and 36 will have all blanks only if 2 or 3 appears in the box of question 33.

5. Question 43 can be blank only if a 2 is marked in the box of question 42.

6. Question 50: If 6 appears in left most box the next two boxes must be blank.

7. Question 58 may have no digits in its two boxes.

NOTE: A set of joined boxes must contain all digits or all blanks.

E. Wherever the number corresponding to "other" appears in the answer box(es), the lines following "Other (specify)" must contain information. Similarly for "None (explain)", "Not Applicable (explain)"______________ (specify), or ________________ (explain).

F. The only writing to the left of the alternatives for each question should be within the boxes or immediately beneath the box when the contents of the box have been crossed out and replaced (by

either the interviewee or the editor). No comments or explanations (digital or other) should appear in the vicinity of the boxes.

SPECIFIC EDIT OF EACH INTERVIEW GUIDE

19. For investigated chunks the box must contain 1, 2, or 3.

20. For any one investigated chunk, if the entries for question 20 are the same as for question 18 (content and order), those entries should be crossed out, and a 29 put in the top box.

32. If 1 appears in the box, an explanation must appear on the "Yes" line.

34. Numbered answers should appear in corresponding boxes proceeding from left to right on first line, then left to right on second line; example: if the interviewee stated that his company information center has abstract service (02), films and projection service (06), and library telephone checkout service (07), the answer boxes would look like this:

		0	2						
0	6	0	7						

NOTE: If 10 appears in its box, all the other boxes should be blank.

41. If a 1 appears in its box, specific data center(s) must be given on "Yes" line.

44. If a 1 appears in box, usual source and language must be written on "Yes" line.

45. If a 1 appears in box, questions 46 and 47 must contain an answer.

50. If more than one degree, all must be described on appropriate lines.

58. This pair of boxes must either contain two digits or two blanks.

APPENDIX 12. DETAILED STRUCTURE

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APPENDIX 12. DETAILED STRUCTURE[1]

I. USER

A. Q48. User's Year of Birth/Age

In what year were you born?

	Year of Birth	Age	Scale*	Percent
I.	1896 - 1905	60 - 69	0.92 - 1.00	1.2
II.	1906 - 1915	50 - 59	0.77 - 0.91	9.4
III.	1916 - 1925	40 - 49	0.61 - 0.76	30.9
IV.	1926 - 1935	30 - 39	0.46 - 0.60	44.4
V.	1936 - 1945	20 - 29	0.31 - 0.45	14.1

*(1965 - Year of Birth)/65 and truncated to 1.00

B. User's Education

1. Q50A. User's Highest Degree

What is your highest college degree?

			Scale	Percent
I.	(6)	None	0.00	13.1
II.	(1)	Associate's	0.25	1.9
III.	(2)	Bachelor's	0.50	53.2
IV.	(3)	Master's	0.75	19.7
V.	(4)	Professional (Ed.D, LLB, Engr)	0.87	1.7
VI.	(5)	Doctors	1.00	10.4

2. Q50C. User's Field of Degree (distance from public or degree of abstraction)

In what Field is your highest degree?

			Scale	Percent
I.	(00)	No degree	0.00	13.1

---

[1] Arabic numerals in parentheses indicate the ordering in the Interview Guide, while Roman numerals indicate the ordering in the detailed structure. In the analysis, no distinction is made among responses which have the same Roman numeral.

		Scale	Percent
II.	Behavioral and Social Scineces	0.08	5.9
(01)	Arts		0.1
(17)	Business and Business Administration		1.8
(40)	Economics		0.4
(41)	Education		0.6
(01)	English		0.2
(01)	General Studies		0.1
(45)	Geography		0.1
(44)	History		0.2
(01)	Journalism		0.1
(01)	Languages		0.1
(43)	Law		0.2
(01)	Library Science		0.1
(01)	Philosophy		0.1
(42)	Political Science		0.4
(06)	Psychology		1.3
(46)	Sociology		0.1
III.	Biological and Medical Sciences	0.15	1.7
(02)	Biology		0.4
(37)	Dentistry		0.1
(39)	Medicine		0.7
(35)	Pharmacy		0.1
(31)	Physiology		0.3
(39)	Public Health		0.1
(38)	Zoology		0.1

		Scale	Percent	
IV.	Agriculture and Agricultural Engineering (27 and 34)	0.23		0.1
V.	General Engineering	0.31		3.2
(07)	Engineering Management		0.3	
(07)	General Engineering		1.8	
(12)	Industrial Engineering		1.0	
(24)	Systems Engineering		0.1	
VI.	Civil Engineering	0.38		2.4
(26)	Architectural Engineering		0.1	
(10)	Civil Engineering		2.1	
(15)	Military Science		0.1	
(10)	Naval Architectural Engineering		0.1	
VII.	Mechanical Engineering	0.46		15.3
(25)	Automotive Engineering		0.1	
(13)	Engineering Mechanics		0.1	
(21)	Maintenance Engineering		0.1	
(13)	Marine Engineering		0.1	
(13)	Mechanical Engineering		14.9	
VIII.	Chemical Engineering	0.54		4.2
(09)	Chemical Engineering		4.2	
IX.	Aeronautical Engineering	0.62		7.7
(20)	Aeronautical Engineering		6.4	
(30)	Aeronautics		0.4	
(08)	Aerospace Engineering		0.9	
X.	Electrical Engineering	0.69		22.1
(11)	Electrical Engineering		22.1	

			Scale	Percent
XI.	Chemistry		0.77	7.3
	(03)	Chemistry		7.3
XII.	Earth Sciences		0.85	2.6
	(23)	Ceramic Engineering		0.3
	(33)	Geology and Mineralogy		0.6
	(36)	Geophysics		0.1
	(14)	Metallurgy and Metallurgical Engineering		1.4
	(14)	Mining Engineering		0.1
	(22)	Petroleum Engineering		0.1
XIII.	Physical Science		0.92	9.0
	(16)	Applied Science		0.1
	(18)	Engineering Science		0.3
	(16)	General Science		0.2
	(32)	Meteorology and Astronomy		0.1
	(05)	Physics		8.3
XIV.	Mathematical Science		1.00	5.4
	(04)	Mathematical Science		5.4

3. Q50B. User's Year of Degree

(Not scaled)

C. User's Experience

1. Q51. User's Job Experience (time)

About how long have you been doing your present kind of work?

		Scale*	Percent
I.	0 - 5 years	0.00 - 0.13	32.0
II.	6 - 10 years	0.14 - 0.25	29.2

*(Number of years)/40 and truncated to 1.00

		Scale*	Percent
III.	11 - 15 years	0.28 - 0.38	19.7
IV.	16 - 20 years	0.39 - 0.50	10.2
V.	21 - 25 years	0.51 - 0.63	4.7
VI.	26 - 30 years	0.64 - 0.75	2.7
VII.	More than 30 years	0.76 - 1.00	1.5

*(Number of years)/40 and truncated to 1.00

2. Q52. User's Company Experience (time)

About how long have you been associated with this company?

		Scale*	Percent
I.	0 - 5 years	0.00 - 0.13	32.5
II.	6 - 10 years	0.14 - 0.25	32.5
III.	11 - 15 years	0.26 - 0.38	20.5
IV.	16 - 20 years	0.39 - 0.50	8.3
V.	21 - 25 years	0.51 - 0.63	3.3
VI.	26 - 30 years	0.64 - 0.75	2.0
VII.	More than 30 years	0.76 - 1.00	0.9

*(Number of years)/40 and truncated to 1.00

D. User's Position

1. Q55. User's Kind of Position (research, development, and production cycle)

What kind of work do you do?

			Scale	Percent
I.	(2)	Research - basic	0	4.3
II.	(1)	Research - applied	0.09	16.3
III.	(11)	System analysis	0.18	9.9
IV.	(3)	Development - advanced	0.27	9.7

			Scale	Percent
V.	(4)	Development - engineering	0.36	18.8
VI.	(5)	Development - operational system	0.45	9.3
VII.	(6)	R&D support	0.55	10.1
VIII.	(7)	Test or evaluation	0.64	8.2
IX.	(8)	Production processes	0.73	4.6
X.	(9)	Production end-items	0.82	2.8
XI.	(10)	Reliability or quality control	0.91	4.2
XII.	(12)	Customer relations	1.00	1.7
None.	(13)	Other		0.1

2. Q56. User's Field of Position (distance from public or degree of abstraction)

What is the field of your work?

			Scale	Percent	
I.	Production, Management, and Social Sciences		0.08		10.6
	(32)	Miscellaneous arts and sciences		1.1	
	(28)	Personnel and training		0.7	
	(26)	Production and management		8.0	
	(23)	Psychology and human engineering		0.8	
II.	Medical Sciences		0.19		2.0
	(16)	Medical sciences		2.0	
III.	Mechanical, Industrial, Civil, and Marine Engineering		0.42		5.6
	(11)	Ground transportation equipment		0.3	
	(13)	Installations and constructions		2.1	
	(18)	Military sciences and operations		2.1	
	(24)	Photography and other reproduction processes		0.1	
	(29)	Quartermaster equipment and supplies		0.0	

			Scale	Percent	
	(31)	Ships and marine equipment		0.8	
	(33)	Transportation		0.2	
IV.		Aeronautics and Space Technology	0.62		22.5
	(01)	Aircraft and flight equipment		13.9	
	(12)	Guided Missiles		7.1	
	(19)	Navigation		1.5	
V.		Electronics and Electrical Engineering	0.69		26.7
	(05)	Communications		1.6	
	(06)	Detection		0.9	
	(07)	Electrical equipment		1.9	
	(08)	Electronics, electronic equipment		22.3	
VI.		Chemical Science and Materials	0.81		10.6
	(03)	Chemical warfare equipment and materials		0.3	
	(04)	Chemistry		4.9	
	(10)	Fuels and combustion		0.4	
	(14)	Materials (nonmetallic)		2.6	
	(17)	Metallurgy		1.5	
	(22)	Ordnance		0.9	
VII.		Physical Science	0.92		12.4
	(02)	Astronomy, geophysics and geography		0.8	
	(09)	Fluid mechanics		1.9	
	(20)	Nuclear physics and nuclear chemistry		0.7	
	(21)	Nuclear propulsion		0.1	

			Scale	Percent
	(25)	Physics		4.0
	(27)	Propulsion systems		4.9
VIII.	Research and Research Equipment		0.96	7.6
	(30)	Research and research equipment (including computer science)		7.6
IX.	Mathematics		1.00	1.8
	(15)	Mathematics		1.8
None.	Other			0.2
	(34)	Other		0.2

3. Q57. User's MOS Equivalent (job title):
(Not ordered or scaled.)

E. User's Level

1. Q58. User's Equivalent GS Rating

What is your equivalent GS rating?

				Scale	Percent
I.	(01)	GS-6	(under 6,000)	0.07	0.0
II.	(02)	GS-9	(6,000 - 7,999)	0.15	1.9
III.	(03)	GS-11	(8,000 - 10,249)	0.23	17.2
IV.	(04)	GS-12	(10,250 - 11,999)	0.30	19.2
V.	(05)	GS-13	(12,000 - 13,999)	0.39	19.0
VI.	(06)	GS-14	(14,000 - 16,499)	0.46	19.6
VII.	(07)	GS-15	(16,500 - 18,999)	0.54	12.3
VIII.	(08)	GS-16	(19,000 - 20,999)	0.60	4.7
IX.	(09)	GS-17	(21,000 - 23,999)	0.70	3.3
X.	(10)	GS-18	(24,000 - 26,999)	0.76	1.7
XI.	(11)	Sp A	(27,000 - 29,999)	0.85	0.5
XII.	(12)	Sp B	(30,000 - 34,999)	0.92	0.3
XIII.	(13)	Sp C	(over 35,000)	1.00	0.3

2. Q49. Number of Personnel Supervised by User

How many technical personnel do you supervise?

		Scale*	Percent
	None	0.02	40.3
I.	1 - 5	0.04 - 0.12	31.4
II.	6 - 10	0.13 - 0.22	13.5
III.	11 - 15	0.23 - 0.32	4.1
IV.	16 - 20	0.33 - 0.42	2.3
V.	21 - 25	0.43 - 0.52	1.7
VI.	26 - 30	0.53 - 0.62	1.4
VII.	31 - 35	0.63 - 0.72	0.9
VIII.	36 - 40	0.73 - 0.82	0.5
IX.	41 - 45	0.83 - 0.92	0.4
X.	46 - 50	0.93 - 1.00	0.5
XI.	51 - 75	1.00	1.2
XII.	76 - 100	1.00	0.6
XIII.	101 - 200	1.00	0.8
XIV.	More than 200	1.00	0.4

*(Number of Personnel +1)/50 and truncated to 1.0

3. Q54. User's Type of Activity (extent of management)

In what TYPE of activity are you primarily engaged?

			Scale	Percent
I.	(5)	Technical evaluation	0.17	12.2
II.	(4)	Scientific and engineering (nonmanagement)	0.33	54.9
III.	(2)	Technical management	0.67	11.4
IV.	(1)	Administrative management	0.83	1.9
V.	(3)	Both administrative and technical management	1.00	19.6

II. TASK

A. Task Direction

1. Q2. Task Initiator (distance from user)

What prompted the task?

			Scale	Percent
I.	(4)	Initiative of respondent	0	13.6
II.	(5)	Decision by respondent and colleagues	0.20	8.0
III.	(6)	Application of standard procedures	0.40	8.5
IV.	(3)	Direction by immediate supervisor	0.60	35.8
V.	(2)	Direction by higher management	0.80	18.8
VI.	(1)	Instruction or questions directed from the customer	1.00	15.3

2. Q7 Task Recipient (distance from user)

To whom was the major output of the task directed?

			Scale	Percent
I.	(1)	Individual's own use	0	1.5
II.	(2)	Individual(s) within the respondent's company	0.25	59.3
III.	(5)	A particular contractor or contractors	0.50	11.5
III.	(6)	Department of Defense	0.50	17.8
III.	(7)	NASA	0.50	5.2
IV.	(3)	Members of the respondent's profession	0.75	3.0
V.	(4)	A major segment of an industry	1.00	1.5
None.	(9)	Other		0.2

B. Content of Task

1. Q9. Kind of Task (research, development, and production cycle)

What was the kind of the major output of the task?

			Scale	Percent
I.	(2)	Research - basic	0	4.3
II.	(1)	Research - applied	0.09	15.9
III.	(11)	System analysis	0.18	11.5
IV.	(3)	Development - advanced	0.27	9.8
V.	(4)	Development - engineering	0.36	12.5
VI.	(5)	Development - operational system	0.45	10.9
VII.	(6)	R&D support	0.55	7.9
VIII.	(7)	Test or evaluation	0.64	12.7
IX.	(8)	Production processes	0.73	4.6
X.	(9)	Production end-items	0.82	3.9
XI.	(10)	Reliability or quality control	0.91	4.6
XII.	(12)	Customer relations	1.00	1.4

2. Q8. Class of Task (conceptual, design and performance, and production cycle)

What was the class of the major output of the task?

			Scale	Percent
I.	(Only used for Question 16, Desired Class of Information)			
II.	(1)	Concepts	0	8.6
III.	(8)	Raw data	0.08	1.6
IV.	(5)	Math aids and formulae; computer programs	0.17	6.3
V.	(3)	Designs or design techniques	0.25	24.2
VI.	(4)	Experimental processes and procedures	0.33	5.0

			Scale	Percent
VII.	(11)	Test processes and procedures	0.42	5.7
VIII.	(13)	Evaluation	0.50	9.4
IX.	(9)	Specifications	0.58	6.2
X.	(6)	Performance and characteristics	0.66	16.1
XI.	(7)	Production processes and procedures	0.75	5.9
XII.	(10)	Technical status	0.83	3.8
XIII.	(12)	Utilization	0.92	3.5
XIV.	(2)	Cost and funding; administrative action	1.00	3.7

3. Q10. Field of Task (distance from public or degree of abstraction)

What was the field of the major output of the task?

			Scale	Percent
I.	Production, Management, and Social Sciences		0.08	9.6
	(32)	Miscellaneous arts and sciences		0.7
	(23)	Personnel and training		0.9
	(26)	Production and management		6.8
	(28)	Psychology and human engineering		1.2
II.	Medical Sciences		0.19	2.2
	(16)	Medical sciences		2.2
III.	Mechanical Industrial, Civil, and Marine Engineering		0.42	6.3
	(11)	Ground transportation equipment		0.5
	(13)	Installations and construction		2.4
	(18)	Military sciences and operations		1.4
	(24)	Photography and other reproductive processes		0.5

			Scale	Percent	
	(29)	Quartermaster equipment and supplies		0.0	
	(31)	Ships and marine equipment		1.2	
	(33)	Transportation		0.3	
IV.	Aeronautics and Space Technology		0.62		23.4
	(01)	Aircraft and flight equipment		13.2	
	(12)	Guided Missiles		8.5	
	(19)	Navigation		1.7	
V.	Electronics and Electrical Engineering		0.69		23.6
	(05)	Communications		2.3	
	(06)	Detection		2.3	
	(07)	Electrical equipment		2.0	
	(08)	Electronics, electronic equipment		17.0	
VI.	Chemical Science and Material		0.81		12.1
	(03)	Chemical warfare equipment materials		0.1	
	(04)	Chemistry		4.4	
	(10)	Fuels and combustion		0.6	
	(14)	Materials (nonmetallic)		3.8	
	(17)	Metallurgy		2.3	
	(22)	Ordnance		0.9	
VII.	Physical Science		0.92		12.8
	(02)	Astronomy, geophysics and geography		0.9	
	(09)	Fluid mechanics		2.9	
	(20)	Nuclear physics and nuclear chemistry		0.5	

			Scale	Percent	
	(21)	Nuclear propulsion		0.2	
	(25)	Physics		3.4	
	(27)	Propulsion systems		4.9	
VIII.	Research and Research Equipment		0.96		8.7
	(30)	Research and research equipment (including computer service)		8.7	
IX.	Mathematics		1.00		0.9
	(15)	Mathematics		0.9	
None.	Other				0.4
	(34)	Other		0.4	

C. Form of Task Output

1. Q6. Formality of Task Output

How was the major output of the task presented or transmitted?

			Scale	Percent
I.	(5)	Hardware	0.17	1.0
II.	(4)	Informal briefing or discussion	0.33	6.7
III.	(3)	Informal document or memorandum	0.50	21.9
IV.	(2)	Formal briefing or demonstration	0.83	4.2
V.	(1)	Formal document	1.00	66.1
None.	(6)	Other		0.1

2. Q5. Type of Task Output (how specific)

What was the major output of the task?

			Scale	Percent
I.	(7)	Hardware	0.14	5.9
II.	(1)	Technical data or information	0.29	18.1
None.	(6)	A design (includes specifications)	0.43	19.6

			Scale	Percent
IV.	(2)	A finding	0.57	13.1
V.	(3)	A recommendation	0.71	24.5
VI.	(4)	A decision	0.86	3.7
VII.	(5)	A plan	1.00	14.8
None.	(8)	Other		0.3

D. Task Time

1. Q3. Task Duration (elapsed time)

What was the total elapsed time that you were active on this task, from the time you started it until the time you finished it, including periods during which you may have been diverted to other activities?

			Scale	Percent
I.	(1)	1-7 days	0.01	12.2
II.	(2)	8-14 days	0.03	7.4
III.	(3)	15-21 days	0.05	9.0
IV.	(4)	22-30 days	0.07	10.9
V.	(5)	31-90 days	0.15	27.4
VI.	(6)	91-180 days	0.30	16.8
VII.	(7)	181-270 days	0.50	5.5
VIII.	(8)	271-365 days	0.70	6.3
IX.	(9)	Over 365 days	1.00	4.5

2. Q4. Percentage of Time on Task

During the total elapsed time that you were active on this task, about what percentage of your work time did you devote directly to the task?

			Scale	Percent
I.	(1)	Under 25 percent	0.12	22.0
II.	(2)	25-49 percent	0.37	18.2

			Scale	Percent
III.	(3)	50-74 percent	0.62	21.2
IV.	(4)	75-99 percent	0.87	16.7
V.	(5)	Full Time	1.00	21.9

E. Q1. Description of Task (narrative):
(Not ordered or scaled)

III. UTILIZATION

A. Company TIC

1. Q33. Existence of Company TIC

Does your company have a technical information center or similar library facility?

			Scale	Percent
II.	(1)	Yes	1.00	99.3
I.	(2)	No	0	0.4
I.	(3)	Not sure	0	0.3

2. Q35. Use of Company TIC

How often do you use your company information center?

			Scale	Percent
I.	(4)	Never	0	4.8
II.	(3)	Only on an as-needed basis	0.25	26.9
III.	(2)	Regularly - infrequently (once a month)	0.50	14.5
IV.	(1)	Regularly - frequently (twice or more a month)	1.00	53.8

3. Q36. Evaluation of Company TIC (extent of need satisfaction)

How would you categorize or describe your company information center as to its satisfaction of your information/data needs?

			Scale	Percent
I.	(5)	Never use information center	0	6.0
II.	(3)	Center is too far from my work location	0.10	3.9

			Scale	Percent
III.	(2)	Seldom get what is needed	0.20	11.9
IV.	(4)	Takes too long to get available information	0.40	9.1
V.	(1)	Almost always find needed information	1.00	58.6
None.*	(6)	Entire TIC incomplete		1.4
None.*	(6)	Material coverage inadequate		5.4
None.*	(6)	Structure and mechanics poor		1.4
None.*	(6)	Personnel inadequate		0.5
None.*	(6)	Services inadequate		1.8

*These were not differentiated in the computer ordering and scaling

4. Q34. Known Company TIC Services (TIC quality)

What services, facilities and documents does your company information center have?

			Scale	Percent
I.	(10)	Not familiar with company information center	0	4.5
II.	(3)	Acquisition lists	0.11	76.4
III.	(4)	Awareness/special interest service/SDI	0.22	36.7
IV.	(5)	Information retrieval (search) service	0.33	73.9
V.	(7)	Library telephone checkout service	0.44	43.5
VI.	(1)	Bibliography service	0.55	64.3
VII.	(2)	Abstract service	0.66	51.2
VIII.	(8)	Micro-form and associated reader-printer services (e.g., microfilm, microfiche, aperture cards, etc.)	0.77	67.2
IX.	(6)	Films and projection service	0.88	48.6
X.	(9)	Translation, book purchasing, reproduction, etc.	1.00	8.9

B. Use of Specialized Information Centers

1. Q40. Use of DOD Specialized Information Centers (extent)

Of the DOD specialized information and data centers shown on the following list, which one do you use most often?

			Scale	Percent
I.	(29)	Do not know of such centers	-1.00	36.6
II.	(31)	Use other sources instead	0	12.7
II.	(30)	Not relevant	0	6.7
III.	(1-28)	Use centers	1.00	44.0

2. Q41. Use of Other Specialized Information Centers

Do you use any specialized information and/or data centers other than those listed?

			Scale	Percent
I.	(2)	No	0.00	69.8
II.	(1)	Yes	1.00	30.2

C. Use of Specialized Information Services

1. Q38. Use of STAR (how frequently)

How often do you see or read STAR (Scientific and Technical Aerospace Reports)?

			Scale	Percent
I.	(5)	Do not know of STAR	-0.08	63.6
II.	(4)	Never	0	17.9
III.	(3)	About once every 6 months	0.08	7.5
IV.	(2)	Once every 2 or 3 months	0.42	4.7
V.	(1)	Every issue or almost every issue	1.00	6.3

2. Q44. Use of English Abstracts or Translations

Do you use English translations or English abstracts of foreign literature?

			Scale	Percent
I.	(2)	No	0	60.3
II.	(1)	Yes	1.00	39.7

D. Use of TAB and DDC

1. Q37. Use of TAB (how frequently)

How often do you see or read TAB (Technical Abstract Bulletin)?

			Scale	Percent
I.	(5)	Do not know of TAB	-0.08	43.3
II.	(4)	Never	0	21.7
III.	(3)	About once every 6 months	0.08	13.5
IV.	(2)	Once every 2 or 3 months	0.42	7.8
V.	(1)	Every issue or almost every issue	1.00	13.7

2. Q39. Use of DDC (extent)

Do you use DDC (Defense Documentation Center) (ASTIA)?

			Scale	Percent
I.	(3)	Do not know of DDC	-1.00	31.5
II.	(2)	Know of DDC, but do not use it	0	16.0
II.	(5)	Use other sources instead	0	5.7
II.	(4)	Not relevant	0	1.5
III.	(1)	Yes, including own library going to DDC	1.00	45.3

E. Utilization Problems

1. Q42. Encounter of Restrictions

Have you encountered any special restrictions which made it difficult to obtain information needed in your work?

			Scale	Percent
I.	(2)	No	1.00	65.0
II.	(1)	Yes	0	35.0

2. Q43. Nature of Restrictions

What was the nature of the restrictions(s)?

		Scale	Percent
I.	Proprietary	0.33	40.8
	Unwillingness of vendors to supply drawings and information - fear of commercial competition.		17.0
	Vendors reluctant to provide failure analysis reports.		2.0
	Unwillingness of other companies to supply company classified information.		8.4
	Other companies very jealous of technical processes.		3.5
	Other companies jealous of "developmental" data.		1.3
	"Primes" reluctant to release proprietary information when they sub-contract.		0.7
	Proprietor's reports are evasive and furnish insufficient data.		0.7
	Other companies refuse information on materials composition.		0.7
	"Specs" not available from other companies.		0.2
	Proprietary restrictions preclude knowing what information to request.		0.7

		Scale	Percent
	Government funded programs withheld as proprietary.		2.9
	Limited documents very difficult to obtain		1.8
	Miscellaneous.		0.9
	Total (I)		40.8
		Scale	Percent
II.	Industrial (Government) Security	0.66	59.2
	Not having proper need to know.		16.5
	Takes too long to establish need to know.		7.5
	Administrative procedures make it difficult to establish need to know.		6.0
	Establishing need to know too burdensome - decided not to pursue any further.		2.0
	Difficulty in justifying need to know to DOD contracting officer.		1.3
	Can't acquire information to submit unsolicted proposal because of need to know restriction.		0.9
	Establishment of need-to-know jeopardizes competitive position of company		0.2
	Documents seem to be over-classified		2.2
	Unable to get cleared at proper level.		2.0
	Security requirements keep documents in dark.		1.8
	Difficulty in getting data because of restrictions imposed by (a) DOD and Military services		7.5
	(b) NASA, AEC and STATE.		3.1
	Intelligence data almost impossible to obtain.		0.9
	Classified documents take too long to get.		7.5
	Total (II)		59.2

3. Q45. Encounter of Difficulties

With respect to all the tasks you have worked on over the last year, did you have any difficulty obtaining or locating technical information needed to perform or complete these tasks?

			Scale	*Percent
I.	(2)	No	1.00	57.4
II.	(1)	Yes	0	42.6

4. Q46. Nature of Difficulties

Would you explain the difficulty?

		Scale	*Percent	
I.	Utility of Information	0.33		7.6
	Internal to Company		1.0	
	External to Company		4.0	
	Both		2.6	
II.	Timely Acquisition of Information	0.66		53.2
	Internal to Company		16.6	
	External to Company		27.6	
	Both		9.0	
III.	Timely Awareness of Information	1.00		39.2
	Internal to Company		13.4	
	External to Company		13.5	
	Both		12.4	
	Other			

*Based on the 639 users for which the answer to Q45 was "yes."

5. Q47. Solutions for Difficulties

Not ordered or scaled

IV. SEARCH AND ACQUISITION

A. Information

1. Q16. Desired Class of Information (conceptual, design and performance, and production cycles; location of request to first source)

What question(s) did you want answered by this first source?

			Scale	Percent
I.	(15)	Requested information source	0	4.2
II.	(1)	Concepts	0	1.1
III.	(8)	Raw data	0.08	1.3
IV.	(5)	Math aids and formulae; computer programs	0.17	3.9
V.	(3)	Designs or design techniques	0.25	10.6
VI.	(4)	Experimental processes and procedures	0.33	0.8
VII.	(11)	Test processes and procedures	0.42	3.8
VIII.	(13)	Evaluation	0.50	4.4
IX.	(9)	Specifications	0.58	11.6
X.	(6)	Performance and characteristics	0.66	28.9
XI.	(7)	Production processes and procedures	0.75	2.5
XII.	(10)	Technical status	0.83	12.4
XIII.	(12)	Utilization	0.92	4.4
XIV.	(2)	Cost and funding; administrative action	1.00	10.1
None	(14)	Other		0.0

1. Q28. Class of Information (conceptual, design and performance, and production)

What was the class of this chunk?

			Scale	Percent
I.	Only used for Question 16, Desired Class of Information			
II.	(1)	Concepts	0	7.1

			Scale	Percent
III.	(8)	Raw data	0.08	6.9
IV.	(5)	Math aids and formulae; computer programs	0.17	7.2
V.	(3)	Designs or design techniques	0.25	10.2
VI.	(4)	Experimental processes and procedures	0.33	3.5
VII.	(11)	Test processes and procedures	0.42	4.4
VIII.	(13)	Evaluation	0.50	3.5
X.	(9)	Specifications	0.58	15.2
X.	(6)	Performance and characteristics	0.66	25.2
XI.	(7)	Production processes and procedures	0.75	4.2
XII.	(10)	Technical status	0.83	6.1
XIII.	(12)	Utilization	0.92	3.5
XIV.	(2)	Cost and funding; administrative action	1.00	3.0
None	(14)	Other		0.0

3. Q29. Field of Information (distance from public or degree of abstraction)

What was the field of this chunk?

			Scale	Percent
I.	Production, Management and Social Sciences		0.08	11.5
	(32)	Miscellaneous arts and sciences		1.0
	(23)	Personnel and training		1.1
	(26)	Production and management		8.1
	(28)	Psychology and human engineering		1.3
II.	Medical Sciences		0.19	1.8
	(16)	Medical sciences		1.8

			Scale	Percent	
III.	Mechanical, Industrial, Civil, and Marine Engineering		0.42		6.6
	(11)	Ground transportation equipment		0.6	
	(13)	Installations and constructions		2.7	
	(18)	Military sciences and operations		1.6	
	(24)	Photography and other reproductive processes		0.4	
	(29)	Quartermaster equipment and supplies		0.1	
	(31)	Ships and marine equipment		0.9	
	(33)	Transportation		0.3	
IV.	Aeronautics and Space Technology		0.62		16.8
	(1)	Aircraft and flight equipment		10.2	
	(12)	Guided Missiles		5.7	
	(19)	Navigation		0.9	
V.	Electronics and Electrical Engineering		0.69		24.2
	(5)	Communications		1.8	
	(6)	Detection		1.8	
	(7)	Electrical equipment		2.5	
	(8)	Electronics, electronic equipment		18.1	
VI.	Chemical Science and Materials		0.81		13.2
	(3)	Chemical warfare equipment		0.2	
	(4)	Chemistry		4.4	
	(10)	Fuels and combustion		0.8	
	(14)	Materials (nonmetallic)		3.5	
	(17)	Metallurgy		3.1	
	(22)	Ordnance		1.2	

			Scale		Percent
VII.	Physical Science		0.92		13.9
	(2)	Astronomy, geophysics and geography		1.2	
	(9)	Fluid mechanics		2.9	
	(20)	Nuclear physics and nuclear chemistry		0.6	
	(21)	Nuclear propulsion		0.1	
	(25)	Physics		4.9	
	(27)	Propulsion systems		4.2	
VIII.	Research and Research Equipment		0.96		8.4
	(30)	Research and research equipment (including computer science)		8.4	
IX.	Mathematics		1.00		3.2
	(15)	Mathematics		3.2	
None	Other				0.4
	(34)	Other		0.4	

4. Q11. Description of Information (narrative)

B. Content of Information Media

1. Q25. Desired Depth of Information Media (detail of media)

At the time you recognized the need for this information chunk, did you want:

			Scale	Percent
I.	(1)	A once-over-lightly?	0.25	7.3
II.	(3)	A specific answer?	0.50	55.9
III.	(2)	A detailed analysis?	1.00	36.8

2. Q22. Desired Volume of Information Media (extent of media)

For each information chunk, did you want:

			Scale	Percent
I.	(4)	All from recall?		7.0
II.	(1)	One report or document?		30.3
III.	(2)	A sampling of the reports and documents available?		21.5
IV.	(3)	All reports and documents that could be found pertinent to the question?		41.2
None	(5)	Other		0.0

3. Q24. Actual Depth of Information Media (detail of media)

For this information chunk did you get:

			Scale	Percent
I.	(1)	A once-over-lightly?	0.25	17.8
II.	(3)	A specific answer?	0.50	50.5
III.	(2)	A detailed analysis?	1.00	31.7

4. Q21. Actual Volume of Information Media (extent of media)

When you received this chunk of information, did you get:

			Scale	Percent
I.	(4)	All from recall?	0	6.9
II.	(1)	One report or document?	0.20	25.5
III.	(2)	A sampling of the reports and documents available?	0.60	38.0
IV.	(3)	All reports and documents that could be found pertinent to the question?	1.00	29.4
V.		Did not receive chunk?		0.2
None	(5)	Other		0.0

C. Form of Information Media

1. Q20. Desired Composition of Information Media (formality)

What were the media you would have rather received (including those actually received)?

			Scale	Percent
I.	(22)	Previous knowledge	0	12.7
II.	(9)	Meetings and symposia	0.04	1.8
III.	(8)	Oral contacts - all other	0.07	18.2
IV.	(7)	Oral contacts with manufacturer	0.11	3.3
V.	(15)	Live demonstrations	0.16	1.0
VI.	(25)	Physical measurement or experiment	0.20	2.3
VII.	(24)	Personal notes, logs and files	0.23	3.1
VIII.	(11)	Correspondence, memos and TWX	0.27	5.8
IX.	(4)	Drawings and schematics	0.31	5.2
X.	(20)	Photographs, maps and films	0.35	0.3
XI.	(5)	Parts Lists	0.40	0.5
XII.	(23)	Computer printout	0.44	1.8
XIII.	(26)	Microfilm or microfiche	0.47	0.4
XIV.	(27)	Slides or motion pictures	0.50	0.2
XV.	(6)	System specification document	0.54	4.7
XVI.	(14)	Newsletters and other mass media	0.58	0.3
XVII.	(1)	Brochures	0.62	1.8
XVIII.	(2)	Catalogs	0.66	1.9
XIX.	(3)	Standards and codes	0.70	1.4
XX.	(10)	Directives	0.74	0.9
XXI.	(12)	Handbooks	0.78	2.8

			Scale	Percent
XXII.	(13)	Manuals	0.82	3.7
XXIII.	(17)	Proposals	0.86	1.2
XXIV.	(18)	Reports	0.90	15.5
XXV.	(16)	Preprints and reprints	0.94	1.1
XXVI.	(21)	Journals	0.97	4.4
XXVII.	(19)	Textbooks	1.00	3.7

2. Q27. Desired Layout of Information Media (formality)

In what physical layout would you have wanted it?

			Scale	Percent
I.	(14)	Recall	0	11.3
II.	(13)	Telephone conversation	0.06	1.5
III.	(11)	Group discussion	0.12	2.5
IV.	(4)	Photographs	0.19	0.2
V.	(3)	Graphics (diagrams, drawings, schematics, flow charts, graphs, maps)	0.25	8.7
VI.	(2)	Tables or lists	0.31	8.9
VII.	(1)	Narrative text	0.37	13.7
VIII.	(18)	Narrative text and tables or lists	0.44	1.1
IX.	(9)	Graphics and lists	0.50	2.8
X.	(8)	Photographs and text	0.56	1.3
XI.	(7)	Graphics and text	0.63	30.5
XII.	(16)	Graphics, text and oral	0.69	7.3
XIII.	(17)	Graphics, text, oral and recall	0.75	2.4
XIV.	(12)	Informal briefing, with chalk or pencil drawings	0.82	6.4
XV.	(5)	Microfilm - microfiche	0.88	0.2

			Scale	Percent
XVI.	(6)	Slides or motion pictures	0.94	0.2
XVII.	(10)	Formal briefing or lecture	1.00	0.5
None	(15)	Other		0.5

3. Q18. Actual Composition of Information Media (formality)

Would you describe the media by which you received this information chunk? If more than one medium was used, indicate the three most important, in order of importance.

			Scale	Percent
I.	(22)	Previous knowledge	0	13.5
II.	(9)	Meetings and symposia	0.04	1.9
III.	(8)	Oral contacts - all other	0.07	20.6
IV.	(7)	Oral contacts with manufacturers	0.11	3.8
V.	(15)	Live demonstrations	0.16	0.8
VI.	(25)	Physical measurement or experiment	0.20	2.7
VII.	(24)	Personal notes, logs and files	0.23	3.5
VIII.	(11)	Correspondence, memos and TWX	0.27	6.1
IX.	(4)	Drawings and schematics	0.31	5.2
X.	(20)	Photographs, maps and files	0.35	0.3
XI.	(5)	Parts lists	0.40	0.5
XII.	(23)	Computer printout	0.44	1.5
XIII.	(26)	Microfilm or microfiche	0.47	0.3
XIV.	(27)	Slides or motion pictures	0.50	0.1
XV.	(6)	System specification document	0.54	4.2
XVI.	(14)	Newsletters and other mass media	0.58	0.4
XVII.	(1)	Brochures	0.62	1.9

			Scale	Percent
XVIII.	(2)	Catalogs	0.66	1.9
XIX.	(3)	Standards and Codes	0.70	1.1
XX.	(10)	Directives	0.74	0.8
XXI.	(12)	Handbooks	0.78	2.3
XXII.	(13)	Manuals	0.82	2.9
XXIII.	(17)	Proposals	0.86	1.2
XXIV.	(18)	Reports	0.90	13.0
XXV.	(16)	Preprints and reprints	0.94	1.2
XXVI.	(21)	Journals	0.97	4.5
XXVII.	(19)	Textbooks	1.00	3.8

4. Q26. Actual Layout of Information Media (formality)

What was the physical layout of this chunk of information when you received it?

			Scale	Percent
I.	(14)	Recall	0	12.0
II.	(13)	Telephone conversation	0.06	2.3
III.	(11)	Group discussion	0.12	3.5
IV.	(4)	Photographs	0.19	0.2
V.	(3)	Graphics (diagrams, drawings, etc.)	0.25	7.8
VI.	(2)	Tables or lists	0.31	8.2
VII.	(1)	Narrative text	0.37	13.2
VIII.	(18)	Narrative text and tables or lists	0.44	1.1
IX.	(9)	Graphics and lists	0.50	2.6
X.	(8)	Photographs and text	0.56	1.0
XI.	(7)	Graphics and text	0.63	26.4
XII.	(16)	Graphics, text and oral	0.69	8.8

			Scale	Percent
XIII.	(17)	Graphics, text, oral and recall	0.75	3.7
XIV.	(12)	Informal briefing, with chalk or pencil drawings	0.82	8.8
XV.	(5)	Microfilm - microfiche	0.88	0.1
XVI.	(6)	Slides or motion pictures	0.94	0.1
XVII.	(10)	Formal briefing or lecture	1.00	0.3
None	(15)	Other		1.1

5. Q19. Usual Composition of Information Media
What media do you use regularly to obtain this information chunk?

			Scale	Percent
I.	(3)	None indicated in Question 18	0	2.9
II.	(1)	Same as those indicated in Question 18	0.50	80.1
III.	(2)	Same as those indicated in Question 18 and other media	1.00	16.9

D. First Source for Information

1. Q15. Why Used First Source for information (attraction of source)

What is the main reason that you used this source first?

			Scale	Percent
I.	(1)	Received with task assignment	0	10.8
II.	(4)	Available, handy or easy to use	0.10	26.6
III.	(6)	Found helpful previously	0.20	6.9
IV.	(3)	Most authoritative	0.40	22.3
V.	(2)	Only source known	0.70	9.5
VI.	(5)	Recalled, or was told, that specific chunk was available from the source	1.00	23.8
None	(7)	Other		0.1

2. Q14. Location of First Source for Information (distance from user)

How did you first go about getting this information chunk?

			Scale	Percent
I.	(1)	Received with task assignment	0	10.7
II.	(4)	Recalled it	0.05	18.9
III.	(9)	Searched own collection	0.10	13.0
IV.	(19)	Respondent's action	0.15	2.5
V.	(3)	Asked subordinate to get it	0.20	4.4
VI.	(5)	Asked a colleague	0.25	14.3
VII.	(2)	Asked my supervisor	0.30	1.3
VIII.	(8)	Requested search of department files	0.35	5.5
IX.	(6)	Asked an internal company consultant	0.45	9.5
X.	(10)	Searched company TIC	0.50	7.4
X.	(7)	Requested library search	0.50	1.8
XI.	(15)	Requested data from manufacturer, vendor or supplier	0.60	4.4
XI.	(14)	Searched manufacturer, vendor or supplier sources	0.60	1.6
XII.	(11)	Searched outside library	0.70	0.6
XIII.	(18)	Asked an external consultant or expert	0.80	0.9
XIV.	(13)	Requested search of DOD information/data center	0.90	0.7
XIV.	(12)	Searched DOD information/data center	0.90	0.6
XV.	(17)	Asked customer	1.00	1.9

3. Q17. Acquisition from First Source for Information (extent)

What did you get from this first source?

			Scale	Percent
I.	(4)	Irrelevant or inappropriate information	-0.25	0.7
II.	(5)	Nothing	0	1.1
III.	(3)	Reference to another source	0.25	4.4
IV.	(2)	Part of the information	0.50	46.9
V.	(1)	All the information needed	1.00	46.9

E. Acquisition Time

1. Q13. Desired Acquisition Time (distance from recall)

From the time you requested this chunk or started to search for it, was there a maximum elapsed time you could have allowed to get it?

			Scale	Percent
I.	(1)	From recall	0	7.1
II.	(2)	Less than 1 day	0.01	15.5
III.	(3)	1 - 7 days	0.05	25.0
IV.	(4)	8 - 30 days	0.20	26.5
V.	(5)	31 - 90 days	0.60	7.3
VI.	(7)	More than 90 days	1.00	18.6

2. Q12. Actual Acquisition Time (distance from recall)

How much time elapsed from the time you requested this chunk of information - or from the time you started to search for it - until you got it?

			Scale	Percent
I.	(1)	From recall	0	11.5
II.	(8)	Task generated	0.005	0.1
III.	(2)	Less than 1 day	0.01	28.6

			Scale	Percent
IV.	(3)	1 - 7 days	0.05	22.5
V.	(4)	8 - 30 days	0.20	18.8
VI.	(5)	More than 30 days	0.60	18.1
VII.	(7)	Received only part of chunk	1.00	0.4

F. Contribution of Information to Task

1. Q30. Essentiality of Information

How essential was this information chunk to the task?

			Scale	Percent
I.	(4)	Neither essential nor helpful to successful task completion	0	0.5
II.	(3)	Not essential, but somewhat helpful to successful task completion	0.25	4.4
III.	(2)	Not essential, but extremely helpful to successful task completion	0.50	17.0
IV.	(1)	Absolutely essential to successful task completion	1.00	78.1

2. Q31. Extensiveness of Information Use

To what extent was this information chunk used in the task?

			Scale	Percent
I.	(6)	Not at all	0	0.7
II.	(5)	As a lead to other information	0.11	0.9
III.	(4)	As background information	0.22	11.5
IV.	(3)	In only small parts of the task	0.33	11.6
V.	(2)	In major portions of the task	0.66	34.3
VI.	(1)	Throughout the entire duration of the task	1.00	41.0

3. Q23. Usefulness of Title Listings or Abstracts (extent)

Would you comment on the usefulness ot title listings or abstracts with regard to this chunk?

			Scale	Percent
I.	(3)	Would not have been useful	0	57.2
II.	(2)	Would have found them useful	0.33	19.6
III.	(1)	Used them for this chunk	1.00	23.2

4. Q32. Discovery of Post Task Information

After you finished the total TASK, did you learn of any relevant information that was available but unknown to you while you were doing the task?

			Scale	Percent
I.	(2)	No	0	79.7
II.	(1)	Yes	1.00	20.3

V. INTERVIEWER ASSESSMENT

A. Q59. Interviewer Assessment of Information User's Needs (extent)

How would you, the interviewer, characterize the respondent's need for external scientific and technical information and data?

			Scale	Percent
I.	(3)	Insignificant need	0.25	19.3
II.	(2)	Moderate need	0.5	48.6
III.	(1)	Large need	1.00	32.1

B. Q63. Interviewer Assessment of Task Creativity

Would you consider the output of the task:

			Scale	Percent
I.	(1)	Communication of existing information?	0	3.7
II.	(2)	Rearrangement of existing information, with little evaluation or analysis?	0.25	18.9

			Scale	Percent
III.	(3)	Extensive evaluation and analysis of existing data?	0.50	36.5
IV.	(4)	Creation of new information, systems or hardware?	1.00	40.9

C. Q62. Interviewer Assessment of Difficulty in Acquisition of Information

When the respondent started the task described in response to Question 1, was a suitable method or procedure of obtaining needed information:

			Scale	Percent
I.	(1)	Quite clear or obvious?	0	33.2
II.	(2)	Fairly clear or obvious?	0.50	51.0
III.	(3)	Neither clear nor obvious?	1.00	15.8

D. Q61. Interviewer Assessment of Difficulty in Use of Information

At the beginning of the task described in response to Question 1, was the choice of method or procedure for using the needed information:

			Scale	Percent
I.	(1)	Obvious or prescribed?	0	16.3
II.	(2)	Entirely or largely independent of professional judgment?	0.25	11.9
III.	(3)	Entirely or largely dependent upon professional judgment?	0.50	64.9
IV.	(4)	Difficult, because methods and procedures were lacking?	1.00	6.9

E. Q60. Interviewer Assessment of Other Opinion (narrative)

(Not ordered or scaled.)

APPENDIX 13. GENERAL STRUCTURE

APPENDIX 13. GENERAL STRUCTURE [1,2]

I. USER

A. User's Year of Birth/Age: Q48

B. User's Education

1. User's Highest Degree: Q50A

Linear Model: 1.: Q50A = + 0.581 - 0.071(Q48)
2.: Q50A = + 0.538

2. User's Field of Degree: Q50C

Linear Model: 1.: Q50C = + 0.772 - 0.393(Q48)
2.: Q50C = + 0.772 - $\underset{-\,-\,-\,-\,-}{0.393(Q48)}$

3. User's Year of Degree: (Q50B)

Used only for one-way and two-way distributions

C. User's Experience

Combination: 1/2(Q51 + Q52)

Linear Model: 1.: 1/2(Q51 + Q52) = - 0.197 + 0.724(Q48)
2.: 1/2(Q51 + Q52) = - 0.197 + $\underline{0.724(Q48)}$

1. User's Job Experience: Q51

2. User's Company Experience: Q52

D. User's Position

1. User's Kind of Position: Q55

Linear Model: 1.: Q55 = + 0.520 + 0.132(Q48) - 0.367(Q50A)
+ 0.002(Q50C) - 0.064(1/2(Q51 + Q52))
2.: Q55 = + 0.533 - $\underline{0.364(Q50A)}$

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[1] Q is an abbreviation for Question, as in Q48

[2] All potentially related question combinations are listed in the first equation of each linear model. In the second equation under each linear model, only related question combinations (those with F to remove > 6.66) are listed. The second equations have the question combinations on the right listed in the order of their contribution to the relationship (decreasing order of their F to remove), with those making a significant contribution to the relationship (30 ≤ F to remove < 90) being partially underlined (- - -), and those making a highly significant contribution to the relationship (F to remove > 90) being underlined (___).

2. User's Field of Position: Q56

Linear Model:

$$\begin{aligned} 1.: \mathrm{Q56} &= +0.648 - 0.152(\mathrm{Q48}) - 0.107(\mathrm{Q50A}) \\ &\quad + 0.302(\mathrm{Q50C}) - 0.038(1/2(\mathrm{Q51} + \mathrm{Q52})) \\ 2.: \mathrm{Q56} &= +0.655 + \underline{0.302(\mathrm{Q50C})} - 0.106(\mathrm{Q50A}) \\ &\quad - 0.179(\mathrm{Q48}) \end{aligned}$$

3. User's MOS Equivalent (Q53 and Q57 - narrative - coded as Q57)

Used only for one-way and two-way distributions

E. User's Level

Combination: 1/2(Q49 + Q58)

Linear Model:

$$\begin{aligned} 1.: 1/2(\mathrm{Q49} + \mathrm{Q58}) &= +0.003 + 0.248(\mathrm{Q48}) + 0.157(\mathrm{Q50A}) \\ &\quad + 0.012(\mathrm{Q50C}) + 0.243\,(1/2(\mathrm{Q51} + \mathrm{Q52})) \\ &\quad + 0.016(\mathrm{Q55}) - 0.053(\mathrm{Q56}) \\ 2.: 1/2(\mathrm{Q49} + \mathrm{Q58}) &= +0.016 + \underline{0.158(\mathrm{Q50A})} \\ &\quad + \underline{0.243(1/2(\mathrm{Q51} + \mathrm{Q52}))} \\ &\quad + \underline{0.246(\mathrm{Q48})} - 0.052(\mathrm{Q56}) \end{aligned}$$

1. User's Equivalent GS Rating: Q58

2. Number of Personnel Supervised by User: Q49

3. User's Type of Activity (Q54)

Used only for one-way and two-way distributions

(An index of flexibility, $|\mathrm{Q56} - \mathrm{Q50C}|$, could be defined)

II. TASK

A. Task Direction

Combination: 1/2(Q2 + Q7)

Linear Model:

$$\begin{aligned} 1.: 1/2(\mathrm{Q2} + \mathrm{Q7}) &= +0.446 + 0.034(\mathrm{Q55}) - 0.002(\mathrm{Q56}) \\ &\quad + 0.020(1/2(\mathrm{Q49} + \mathrm{Q58})) \\ 2.: 1/2(\mathrm{Q2} + \mathrm{Q7}) &= +0.463 \end{aligned}$$

1. Task Initiator: Q2

2. Task Recipient: Q7

B. Content of Task

Combination: 1/2(Q8 + Q9)

Linear Model:

$$\begin{aligned} 1.: 1/2(\mathrm{Q8} + \mathrm{Q9}) &= +0.307 + 0.435(\mathrm{Q55}) - 0.068(\mathrm{Q56}) \\ &\quad - 0.013(1/2(\mathrm{Q49} + \mathrm{Q58})) \\ &\quad - 0.009(1/2(\mathrm{Q2} + \mathrm{Q7})) \\ 2.: 1/2(\mathrm{Q8} + \mathrm{Q9}) &= +0.298 + \underline{0.435(\mathrm{Q55})} - 0.067(\mathrm{Q56}) \end{aligned}$$

1. Kind of Task: Q9

2. Class of Task: Q8

3. Field of Task: Q10

Linear Model:

$$\begin{aligned}1.:\ Q10 &= +\,0.237 - 0.031(Q55) + 0.679(Q56)\\ &\quad - 0.048(1/2(Q49 + Q58)) + 0.006(Q2 + Q7)\\ 2.:\ Q10 &= +\,0.210 + \underline{0.688(Q56)}\end{aligned}$$

C. Form of Task Output

Combination: 1/2(Q5 + Q6)

Linear Model:

$$\begin{aligned}1.:\ 1/2(Q5 + Q6) &= +\,0.689 - 0.001(Q55) - 0.022(Q56)\\ &\quad + 0.170(1/2(Q49 + Q58))\\ &\quad + 0.091(1/2(Q2 + Q7)) - 0.014(1/2(Q8 + Q9))\\ &\quad - 0.083(Q10)\\ 2.:\ 1/2(Q5 + Q6) &= +\,0.677 + \underline{0.172(1/2(Q49 + Q58))}\\ &\quad - 0.097(Q10) + 0.091(1/2(Q2 + Q7))\end{aligned}$$

1. Formality of Task Output: Q6

2. Type of Task Output: Q5

D. Task Time

Combination: (Q3 x Q4)

Linear Model:

$$\begin{aligned}1.:\ Q3\ Q4 &= +\,0.164 - 0.079(Q55) + 0.047(Q56)\\ &\quad - 0.062(1/2(Q49 + Q58)) + 0.080(1/2(Q2 + Q7))\\ &\quad - 0.122(1/2(Q8 + Q9)) - 0.029(Q10)\\ &\quad + 0.020(1/2(Q5 + Q6))\end{aligned}$$

$$\begin{aligned}2.:\ Q3\ Q4 &= +\,0.191 - 0.125(1/2(Q8 + Q9)) - 0.080(Q55)\\ &\quad + 0.081(1/2(Q2 + Q7))\end{aligned}$$

1. Task Duration: Q3

2. Percentage of Time on Task: Q4

E. Description of Task (narrative - Q1): Not used

F. User-Task Flexibility:

Special Index: $F = 1/2(|Q9 - Q55| + |Q10 - Q56|)$

Linear Model:

$$\begin{aligned}1.\ F &= +\,0.114 - 0.009(Q50A) - 0.011(Q50C)\\ &\quad + 0.050(Q55) - 0.047(Q56) + 0.020(1/2(Q49 + Q58))\\ 2.\ F &= +\,0.110 + 0.055(Q55) - 0.052(Q56)\end{aligned}$$

III. UTILIZATION

A. Company TIC

Combination: (Q33 x Q35)

Linear Model:

$$\begin{aligned} 1.: Q33\ Q35 &= +\ 0.631 + 0.220(Q50A) - 0.004(Q50C) \\ &\quad - 0.298(Q55) + 0.032(Q56) \\ &\quad + 0.088(1/2(Q49 + Q58)) \\ 2.: Q33\ Q35 &= +\ 0.668 - \underline{0.300(Q55)} + \underline{0.232(Q50A)} \end{aligned}$$

1. Existence of Company TIC: Q33

2. Use of Company TIC: Q35

3. Evaluation of Company TIC: (Q36)

   Used only for one-way and two-way distributions

4. Known Company TIC Services (Q34)

   Used only for one-way and two-way distributions

B. Use of Specialized Information Centers

Combination: 1/2(Q40 + Q41)

Linear Model:

$$\begin{aligned} 1.: 1/2(Q40 + Q41) &= +\ 0.025 + 0.187(Q50A) - 0.040(Q50C) \\ &\quad - 0.157(Q55) - 0.014(Q56) \\ &\quad + 0.567(1/2(Q49 + Q58)) \\ 2.: 1/2(Q40 + Q41) &= +0.005 + \underline{0.574\ (1/2(Q49 + Q58))} \\ &\quad + 0.162(Q50A) - 0.155(Q55) \end{aligned}$$

1. Use of DOD Specialized Information Centers: Q40

2. Use of Other Specialized Information Centers: Q41

C. Use of Specialized Information Services

Combination: 1/2(Q38 + Q44)

Linear Model:

$$\begin{aligned} 1.: 1/2(Q38 + Q44) &= +\ 0.116 + 0.243(Q50A) - 0.019(Q50C) \\ &\quad - 0.241(Q55) + 0.049(Q56) \\ &\quad + 0.159(1/2(Q49 + Q58)) \\ 2.: 1/2(Q38 + Q44) &= +\ 0.149 - \underline{0.249(Q55)} + \underline{0.234(Q50A)} \\ &\quad + 0.151(1/2(Q49 + Q58)) \end{aligned}$$

1. Use of STAR: Q38

2. Use of English Abstracts or Translations: Q44

D. Use of TAB and DDC

Combination: $1/2(Q37 + Q39)$

1. Use of TAB: Q37

Linear Model:

$$\begin{aligned}
1.: Q37 = &- 0.001 + 0.018(Q50A) + 0.034(Q50C) \\
&- 0.085(Q55) - 0.019(Q56) + 0.001(1/2(Q49 + Q58)) \\
&+ 0.084(Q33\ Q35) + 0.056(1/2(Q40 + Q41)) \\
&+ 0.447(1/2(Q38 + Q44))
\end{aligned}$$

$$\begin{aligned}
2.: Q37 = &+ 0.014 + \underline{0.452(1/2(Q38 + Q44))} \\
&+ 0.056(1/2(Q40 + Q41)) \\
&+ 0.087(Q33\ Q35) - 0.094(Q55)
\end{aligned}$$

2. Use of DDC: Q39

Linear Model:

$$\begin{aligned}
1.: Q39 = &- 0.298 - 0.136(Q50A) + 0.072(Q50C) - 0.589(Q55) \\
&+ 0.099(Q56) + 0.497(1/2(Q49 + Q58)) \\
&+ 0.311(Q33\ Q35) + 0.342(1/2(Q40 + Q41)) \\
&+ 0.385(1/2(Q38 + Q44))
\end{aligned}$$

$$\begin{aligned}
2.: Q39 = &- 0.196 + \underline{0.342(1/2(Q40 + Q41))} - \underline{0.636(Q55)} \\
&+ \underline{0.401(1/2(Q38 + Q44))} + 0.318(Q33\ Q35) \\
&+ 0.516(1/2(Q49 + Q58))
\end{aligned}$$

E. Utilization Problems

1. Utilization Restrictions

Combination: $(Q42 \times Q43)$

Linear Model:

$$\begin{aligned}
1.: Q42\ Q43 = &+ 0.191 - 0.006(Q50A) + 0.063(Q50C) \\
&- 0.074(Q55) - 0.102(Q56) \\
&+ 0.140(1/2(Q49 + Q58)) + 0.005(Q33\ Q35) \\
&+ 0.034(1/2(Q40 + Q41)) + 0.009(1/2(Q38 + Q44)) \\
&+ 0.128(1/2(Q37 + Q39))
\end{aligned}$$

$$\begin{aligned}
2.: Q42\ Q43 = &+ 0.194 + \underline{0.130(1/2(Q37 + Q39))} \\
&+ 0.139(1/2(Q49 + Q58))
\end{aligned}$$

a. Encounter of Restrictions: Q42

b. Nature of Restrictions: Q43

2. Utilization Difficulties

Combination: $(Q45 \times Q46)$

Linear Model:

$$\begin{aligned}
1.: Q45\ Q46 = &+ 0.285 + 0.139(Q50A) - 0.034(Q50C) \\
&- 0.040(Q55) - 0.062(Q56) \\
&- 0.007(1/2(Q49 + Q58)) + 0.015(Q33\ Q35) \\
&+ 0.076(1/2(Q40 + Q41)) + 0.041(1/2(Q38 + Q44)) \\
&+ 0.030(1/2(Q37 + Q39))
\end{aligned}$$

$$\begin{aligned}
2.: Q45\ Q46 = &+ 0.266 + 0.082(1/2(Q40 + Q41)) \\
&+ 0.139(Q50A)
\end{aligned}$$

a. **Encounter of Difficulties:** Q45

b. **Nature of Difficulties:** Q46

c. **Solution for Difficulties** (narrative - Q47): **Not used**

F. Utilization Effort

Special Index:
$$E = 1/4(Q33\ Q35 + 1/2(Q40 + Q41) + 1/2(Q38 + Q44) + 1/2(Q37 + Q39))$$

Linear Model:
$$\begin{aligned} 1.: E &= +0.200 + 0.227(Q50A) - 0.007(Q50C) \\ &\quad -0.306(Q55) + 0.033(Q56) + 0.315(1/2(Q49 + Q58)) \end{aligned}$$

$$\begin{aligned} 2.: E &= +0.223 - \underline{0.311(Q55)} + \underline{0.225(Q50A)} \\ &\quad + \underline{0.309(1/2(Q49 + Q58))} \end{aligned}$$

G. Utilization Problems

Special Index:
$$P = 1/2(Q42\ Q43 + Q45\ Q46)$$

Linear Model:
$$\begin{aligned} 1.: P &= +0.251 + 0.106(Q50A) + 0.015(Q50C) - 0.116(Q55) \\ &\quad - 0.076(Q56) + 0.137(1/2(Q49 + Q58)) \\ 2.: P &= +0.251 + 0.115(Q50A) - 0.115(Q55) \\ &\quad + 0.137(1/2(Q49 + Q58)) \end{aligned}$$

IV. SEARCH AND ACQUISITION

A. Information

1. Desired Class of Information: Q16

Linear Model:
$$\begin{aligned} 1.: Q16 &= +0.496 - 0.012(Q55) - 0.014(Q56) \\ &\quad + 0.162(1/2(Q49 + Q58)) + 0.153(1/2(Q8 + Q9)) \\ &\quad - 0.070(Q10) + 0.066(1/2(Q5 + Q6)) + 0.006(Q3 + Q4) \end{aligned}$$

$$\begin{aligned} 2.: Q16 &= +0.491 + \underline{0.144(1/2(Q8 + Q9))} \\ &\quad + \underline{0.163(1/2(Q49 + Q58))} - 0.079(Q10) \\ &\quad + 0.066(1/2(Q5 + Q6)) \end{aligned}$$

2. Class and Field of Information

a. **Class of Information:** Q28

Linear Model:
$$\begin{aligned} 1.: Q28 &= +0.253 + 0.248(1/2(Q8 + Q9)) - 0.042(Q10) \\ &\quad + 0.056(1/2(Q5 + Q6)) + 0.040(Q3\ Q4) \\ &\quad + 0.159(Q16) + 0.039(1/2(Q14 + Q17)) \\ &\quad - 0.032(1/2(Q21 + Q24)) + 0.032(1/2(Q18 + Q26)) \\ 2.: Q28 &= +0.243 + \underline{0.246(1/2(Q8 + Q9))} + \underline{0.161(Q16)} \\ &\quad + 0.066(1/2(Q5 + Q6)) \end{aligned}$$

b. Field of Information: Q29

Linear Model: 1.: Q29 = + 0.405 - 0.066(1/2(Q8 + Q9)) + 0.600(Q10)
- 0.086(1/2(Q5 + Q6)) + 0.014(Q3 Q4)
- 0.085(Q16) - 0.002(1/2(Q14 + Q17))
- 0.021(1/2(Q21 + Q24)) + 0.022(1/2(Q18 + Q26))
2.: Q29 = +0.410 + 0.601(Q10) - 0.086(Q16)
- 0.085(1/2(Q5 + Q6)) - 0.072(1/2(Q8 + Q9))

3. Description of Information (narrative - Q11): Not used

B. Content of Information Media

1. Desired

Combination: 1/2(Q22 + Q25)

Linear Model: 1.: 1/2(Q22 + Q25) = + 0.610 - 0.040(Q55) - 0.005(Q56)
+ 0.088(1/2(Q49 + Q58))
- 0.048(1/2(Q8 + Q9)) - 0.030(Q10)
+ 0.053(1/2(Q5 + Q6)) + 0.140(Q3 Q4)
+ 0.015 (F) + 0.047 (E) - 0.008(Q16)

2.: 1/2(Q22 + Q25) = + 0.569 + 0.142(Q3 Q4) + 0.053 (E)
+ 0.092(1/2(Q49 + Q58))
- 0.065(1/2(Q8 + Q9))
+ 0.058(1/2(Q5 + Q6))

a. Desired Depth of Information Media: Q25

b. Desired Volume of Information Media: Q22

2. Actual Content of Information Media

Combination: 1/2(Q21 + Q24)

Linear Model: 1.: 1/2(Q21 + Q24) = +0.090 + 0.009(1/2(Q8 + Q9))
+ 0.008(Q10) + 0.032(1/2(Q5 + Q6))
+ 0.003(Q3 Q4) + 0.007(F) - 0.031 (E)
- 0.001 (Q16) + 0.711(1/2(Q22 + Q25))
+ 0.022(1/2(Q20 + Q27))
+ 0.038(1/2(Q14 + Q17))

2.: 1/2(Q21 + Q24) = + 0.120 + 0.712 (1/2(Q22 + Q25))
- 0.030 (E) + 0.022(1/2(Q20 + Q27))
+ 0.039(1/2(Q14 + Q17))

a. Actual Depth of Information Media: Q24

b. Actual Volume of Information Media: Q21

C. Form of Information Media

1. Desired

Combination: 1/2 (Q20 + Q27)

Linear Model:

$$
\begin{aligned}
\text{1.: } 1/2(Q20 + Q27) = {} & +0.374 - 0.051(Q55) - 0.079(Q56) \\
& - 0.025(1/2(Q49 + Q58)) \\
& - 0.048(1/2(Q8 + Q9)) + 0.063(Q10) \\
& - 0.030(1/2(Q5 + Q6)) + 0.109(Q3\ Q4) \\
& + 0.175\ (E) - 0.019(Q16) \\
& + 0.474(1/2(Q22 + Q25)) \\
\text{2.: } 1/2(Q20 + Q27) = {} & +0.316 + \underline{0.472(1/2(Q22 + Q25))} \\
& + \underline{0.166\ (E)} + 0.111\ (Q3\ Q4) \\
& -0.072(Q55)
\end{aligned}
$$

a. Desired Composition of Information Media: Q20

b. Desired Layout of Information Media: Q27

2. Actual Form of Information Media

Combination: 1/2(Q18 + Q26)

Linear Model:

$$
\begin{aligned}
\text{1.: } 1/2(Q18 + Q26) = {} & +0.043 - 0.029(1/2(Q8 + Q9)) \\
& -0.023(Q10) + 0.040(1/2(Q5 + Q6)) \\
& +0.065(Q3\ Q4) + 0.059\ (E) \\
& -0.037(Q16) + 0.845(1/2(Q20 + Q27)) \\
& - 0.046(1/2(Q14 + Q17)) \\
& + 0.121(1/2(Q21 + Q24)) \\
\text{2.: } 1/2(Q18 + Q26) = {} & +0.011 + \underline{0.846(1/2(Q20 + Q27))} \\
& + \underline{0.122\ (1/2(Q21 + Q24))} + \underline{0.062\ (E)} \\
& + 0.069(Q3\ Q4) - 0.037\ (Q16) \\
& - 0.048(1/2(Q14 + Q17)) \\
& + 0.044(1/2(Q5 + Q6))
\end{aligned}
$$

a. Actual Composition of Information Media: Q18

b. Actual Layout of Information Media: Q26

3. Usual Composition of Information Media: (Q19)

Used only for one-way and two-way distributions

D. First Source

Combination: 1/2(Q14 + Q15)

Combination: 1/2(Q14 + Q17)

1. Why Used First Source for Information: Q15

2. Location of First Source for Information: Q14

Linear Model:

$$\begin{aligned}1.:\ Q14 = &-0.040 + 0.059(Q55) + 0.030(Q56)\\ &+ 0.058(1/2(Q49 + Q58)) + 0.116(1/2(Q2 + Q7))\\ &+ 0.031(1/2(Q8 + Q9)) - 0.022\,(Q10)\\ &- 0.012(1/2(Q5 + Q6)) - 0.024(Q3\ Q4) + 0.025(F)\\ &+ 0.056\,(E) + 0.014\,(Q16) + 0.109(1/2(Q22 + Q25))\\ &+ 0.089(1/2(Q20 + Q27)) + 0.086(Q15)\end{aligned}$$

$$\begin{aligned}2.:\ Q14 = &-0.011 + 0.086(Q15) + 0.088(1/2(Q20 + Q27))\\ &+ 0.112(1/2(Q22 + Q25)) + 0.119(1/2(Q2 + Q7))\\ &+ 0.065\,(E) + 0.072(Q55)\end{aligned}$$

3. Acquisition from First Source for Information: Q17

Linear Model:

$$\begin{aligned}1.:\ Q17 = &+0.905 + 0.016(Q55) + 0.006(Q56)\\ &+0.055(1/2(Q49 + Q58)) + 0.010(1/2(Q8 + Q9))\\ &- 0.018(Q10) - 0.017(1/2(Q5 + Q6))\\ &- 0.063(Q3\ Q4) + 0.042\,(F) - 0.010\,(E)\\ &- 0.079\,(P) + 0.006(Q16) - 0.156(1/2(Q22 + Q25))\\ &- 0.196(1/2(Q20 + Q27)) + 0.003(1/2(Q14 + Q15))\end{aligned}$$

$$\begin{aligned}2.:\ Q17 = &+0.966 - 0.198(1/2(Q20 + Q27))\\ &- 0.155(1/2(Q22 + Q25)) - 0.080\,(P)\\ &- 0.071\,(Q3\ Q4)\end{aligned}$$

F. Acquisition Time

1. Desired Acquisition Time: Q13

Linear Model:

$$\begin{aligned}1.:\ Q13 = &-0.074 - 0.102(Q55) + 0.008(Q56)\\ &+ 0.250(1/2(Q49 + Q58)) + 0.034(1/2(Q8 + Q9))\\ &- 0.017(Q10) + 0.005(1/2(Q5 + Q6))\\ &+ 0.756(Q3\ Q4) + 0.048\,(E) + 0.052(Q16)\\ &+ 0.146(1/2(Q22 + Q25)) + 0.096(1/2(Q20 + Q27))\\ &+ 0.062(1/2(Q14 + Q15))\end{aligned}$$

$$\begin{aligned}2.:\ Q13 = &-0.070 + 0.753(Q3\ Q4) + 0.251(1/2(Q49 + Q58))\\ &+ 0.146(1/2(Q22 + Q25)) + 0.095(1/2(Q20 + Q27))\\ &-0.086(Q55) + 0.054(Q16) + 0.063(1/2(Q14 + Q15))\\ &+ 0.048\,(E)\end{aligned}$$

2. Actual Acquisition Time: Q12

Linear Model:

$$\begin{aligned}1.:\ Q12 = &-0.048 - 0.038(Q55) + 0.024(Q56)\\ &+ 0.165(1/2(Q49 + Q58)) + 0.045(1/2(Q8 + Q9))\\ &-0.046(Q10) + 0.016(1/2(Q5 + Q6))\\ &+ 0.354(Q3\ Q4) + 0.042\,(F) + 0.027\,(E)\\ &+ 0.009(1/2(Q14 + Q17)) + 0.059(1/2(Q21 + Q24))\\ &+ 0.089(1/2(Q18 + Q26)) + 0.020(Q28)\\ &- 0.006(Q29)\end{aligned}$$

2.: Q12 = -0.010 + 0.353(Q3 Q4) + 0.088(1/2(Q18 + Q26))
+ 0.167(1/2(Q49 + Q58)) + 0.060(1/2(Q21 + Q24))
+ 0.034(E) - 0.039(Q10)

F. Contribution of Information to Task

Combination: 1/2(Q30 + Q31)

Linear Model: 1.: 1/2(Q30 + Q31) = + 0.764 - 0.019(1/2(Q8 + Q9))
- 0.035 (Q10) + 0.039(1/2(Q5 + Q6))
+ 0.029(Q3 Q4) + 0.007(1/2(Q14 + Q17))
+ 0.115(1/2(Q21 + Q24))
- 0.044(1/2(Q18 + Q26)) - 0.005(Q28)
+ 0.010(Q29) + 0.004(Q12)

2.: 1/2(Q30 + Q31) = + 0.768 + 0.120(1/2(Q21 + Q24))
- 0.041(1/2(Q18 + Q26))

1. Essentiality of Information: Q30

2. Extensiveness of Information Use: Q31

G. Search for Information

1. Usefulness of Title Listings or Abstracts: Q23

Linear Model: 1.: Q23 = - 0.131 + 0.022(Q55) - 0.009(Q56)
- 0.065(1/2(Q49 + Q58)) - 0.181(1/2(Q8 + Q9))
- 0.002(Q10) + 0.117(1/2(Q5 + Q6)) - 0.062(Q3 Q4)
- 0.017 (F) + 0.206 (E) - 0.058(Q16)
+ 0.222(1/2(Q22 + Q25)) + 0.360(1/2(Q20 + Q27))
+ 0.098(1/2(Q14 + Q15)) + 0.048(Q13)

2.: Q23 = - 0.152 + 0.364(1/2(Q20 + Q27)) + 0.198 (E)
+ 0.226(1/2(Q22 + Q25)) - 0.164(1/2(Q8 + Q9))
+ 0.101(1/2(Q14 + Q15)) + 0.114(1/2(Q5 + Q6))
- 0.057 (Q16)

2. Discovery of Post Task Information: Q32

Linear Model: 1.: Q32 = +0.085 + 0.054(Q55) - 0.047(Q56)
- 0.071(1/2(Q49 + Q58)) - 0.136(1/2(Q8 + Q9))
+ 0.074(Q10) -0.001(1/2(Q5 + Q6))
-0.003(Q3 Q4) + 0.043 (F) + 0.090 (E) + 0.131 (P)
+ 0.011(Q16) + 0.090(1/2(Q22 + Q25))
+ 0.050(1/2(Q20 + Q27)) - 0.049(1/2(Q14 + Q15))
- 0.048(Q13)

2.: Q32 = + 0.101 + 0.135 (P) - 0.109(1/2(Q8 + Q9))
+ 0.072 (E) + 0.090(1/2(Q22 + Q25))
+ 0.055(1/2(Q20 + Q27))

H. Inadequacy of Search and Acquisition Process (I)

Special Index:
$$\begin{aligned} I = \frac{1}{6}(&|Q16 - Q28| + |1/2(Q22 + Q25) - 1/2(Q21 + Q24)| \\ &+ |1/2(Q20 + Q27) - 1/2(Q18 + Q26)| + (1-Q17) \\ &+ |Q13 - Q12| + Q32) \end{aligned}$$

Linear Model: 1.: I = +0.410 - 0.005(Q55) - 0.004(Q56) + 0.012(1/2(Q49 + Q58))
- 0.031(1/2(Q8 + Q9)) + 0.014(Q10)
- 0.021(1/2(Q5 + Q6)) + 0.059(Q3 Q4) + 0.013 (F)
+ 0.023 (E) + 0.030 (P)

2.: I = +0.406 + 0.059(Q3 Q4) + 0.029 (P)
- 0.036(1/2(Q8 + Q9)) + 0.024 (E)

V. INTERVIEWER ASSESSMENT

A. Interviewer Assessment of Information Needs of User: Q59

Linear Model: 1.: Q59 = +0.502 + 0.053 (Q50A) - 0.015 (Q50C)
- 0.186(Q55) - 0.037(Q56) + 0.196(1/2(Q49 + Q58))
+ 0.129 (Q33 Q35) + 0.077 (1/2(Q40 + Q41))
+ 0.107 (1/2(Q38 + Q44)) + 0.055 (1/2(Q37 + Q39))

2.: Q59 = +0.492 - 0.194 (Q55) + 0.132 (Q33 Q35)
+ 0.078(1/2(Q40 + Q41)) + 0.219(1/2(Q49 + Q58))
+ 0.111 (1/2(Q38 + Q44)) + 0.056 (1/2(Q37 + Q39))

B. Interviewer Assessment of Task Creativity: Q63

Linear Model: 1.: Q63 = + 0.624 + 0.106 (Q50A) - 0.031 (Q50C)
- 0.128(Q55) + 0.013(Q56) + 0.248(1/2(Q49 + Q58))
- 0.039 (1/2(Q2 + Q7)) - 0.286 (1/2(Q8 + Q9))
- 0.020 (Q10) + 0.099 (1/2(Q5 + Q6)) + 0.245(Q3 Q4)

2.: Q63 = + 0.593 - 0.285 (1/2(Q8 + Q9)) + 0.242 (Q3 Q4)
+ 0.250 (1/2(Q49 + Q58)) - 0.128 (Q55)
+ 0.090(Q50A)

C. Interviewer Assessment of Difficulty in Acquisition and Use of Information

Combination: 1/2(Q61 + Q62)

Linear Model: 1.: 1/2(Q61 + Q62) = + 0.407 - 0.096 (Q55) - 0.047 (Q56)
+ 0.103 (1/2(Q49 + Q58))
- 0.204(1/2(Q8 + Q9)) + 0.022(Q10)
+ 0.098(1/2(Q5 + Q6)) - 0.006(Q3 Q4)
- 0.029(Q16) + 0.024(1/2(Q22 + Q25))
+ 0.063(1/2(Q20 + Q27))
+ 0.024(1/2(Q14 + Q15)) + 0.035 (Q13)

2.: $$\begin{aligned} 1/2(Q61 + Q62) = &+ 0.389 - 0.207\,(1/2(Q8 + Q9)) \\ &+ 0.070\,(1/2(Q20 + Q27)) - 0.092\,(Q55) \\ &+ 0.101\,(1/2(Q5 + Q6)) \\ &+ 0.105(1/2(Q49 + Q58)) + 0.037(Q13) \end{aligned}$$

1. **Interviewer Assessment of Difficulty in Acquisition of Information:** Q62

2. **Interviewer Assessment of Difficulty in Usage of Information:** Q61

D. **Interviewer Assessment, Other Opinions (narrative - Q60):** Not used

APPENDIX 14. SUMMARY OF TWO-WAY FREQUENCY DISTRIBUTIONS

APPENDIX 14. SUMMARY OF TWO-WAY FREQUENCY DISTRIBUTIONS

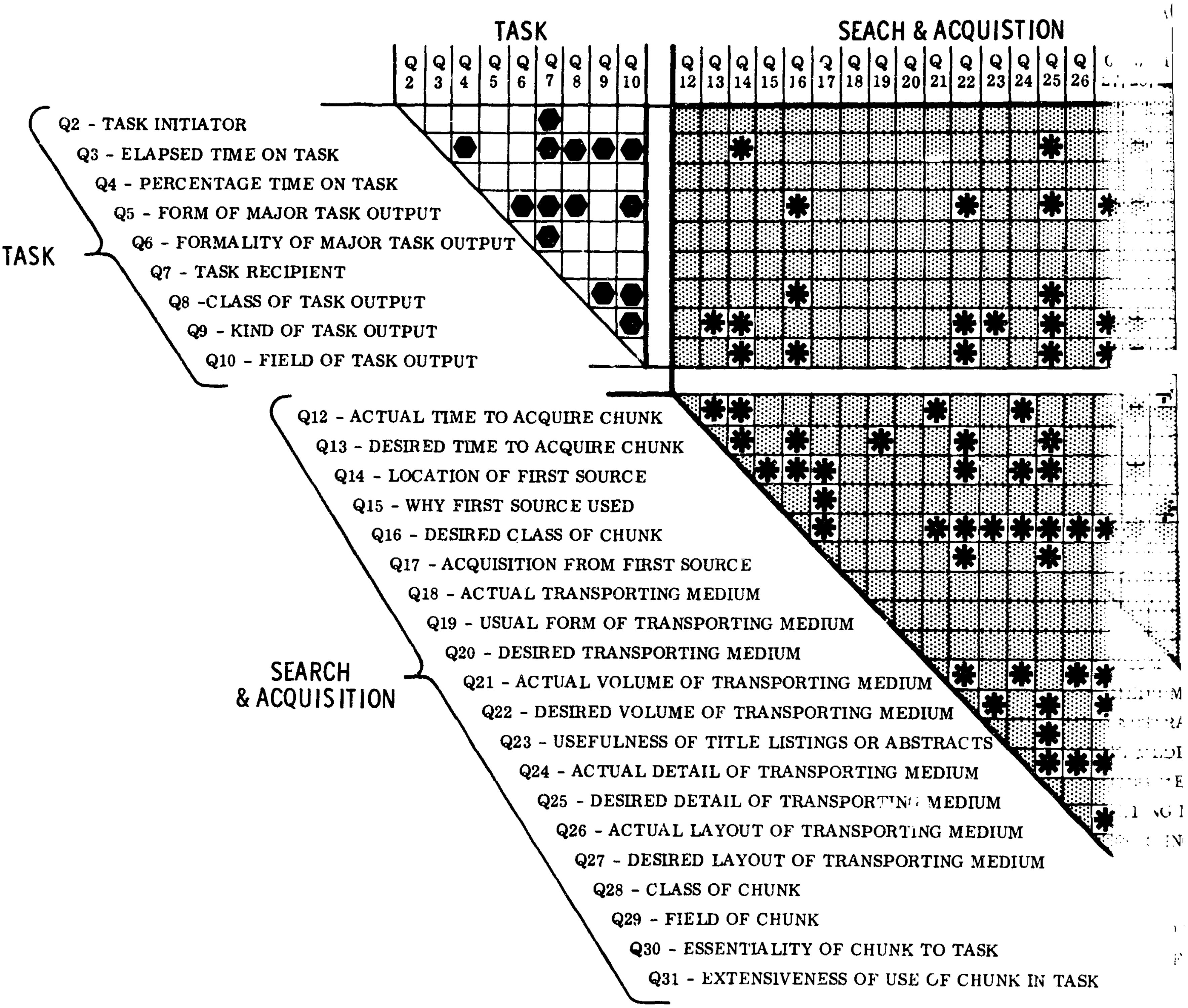
I. INTRODUCTION AND INDEX MATRIX

The two-way frequency distributions run in the Phase II analysis are summarized in this appendix. The actual distribution tables are presented in Volume III. The tables present various elements from the two-way distributions and their interpretation.

The elements from the analysis are: (1) the Chi-square (χ^2) derived by the BIOMED 08D computer program which tests the independence of the two questions, (2) the degrees of freedom (df) relative to the χ^2, (3) the confidence interval for Hypothesis rejection, (4) the correlation coefficient (r) of the table, and (5) remarks about the structure and relationships of the table. Interrelationships are considered to be proportionally high or low when the column and row distributions of two responses are at variance with the total column and row distribution by at least 50 percent. For instance the relationship of Technical Evaluation as a Kind of Activity is considered to be proportionally high for Test or Evaluation, Reliability and Quality Control and Customer Relation Tasks in the two-way table for Question 9 and 54. The population distribution for Technical Evaluation is 12 percent, while for these three task categories it is 23 percent, 23 percent, and 35 percent respectively. Conversely the population for Test or Evaluation, Reliability and Quality Control and Customer Relation tasks are 13 percent, 5 percent and 1 percent; while their distributions within Technical Evaluation personnel (i.e., type of activity) are 28 percent, 9 percent, and 4 percent respectively.

The summaries are presented in two parts. Part I contains the nonchunk question (Q2 - Q10 and Q32 - Q63) two-way frequency distributions, while Part II contains those two-way frequency distributions that concern chunk questions (Q12 - Q31 and their combination with any other question).

The matrix (Figure A14-1) which follows this introduction identifies the two-way tables that were run, and their relative position within the tables in II and III, respectively. For example: beginning at the upper left hand corner of the matrix it is seen that a two-way frequency distribution for Questions 2 and 7 was run. Referring to the tabulation in II, the first entry summarizes the findings of the Q2 vs Q7 two-way frequency distribution.


TASK
SEACH & ACQUISTION
Q 2
Q 3
Q 4
Q 5
Q 6
Q 7
Q 8
Q 9
Q 10
Q 12
Q 13
Q 14
Q 15
Q 16
Q 17
Q 18
Q 19
Q 20
Q 21
Q 22
Q 23
Q 24
Q 25
Q 26
TASK
Q2 - TASK INITIATOR
Q3 - ELAPSED TIME ON TASK
Q4 - PERCENTAGE TIME ON TASK
Q5 - FORM OF MAJOR TASK OUTPUT
Q6 - FORMALITY OF MAJOR TASK OUTPUT
Q7 - TASK RECIPIENT
Q8 -CLASS OF TASK OUTPUT
Q9 - KIND OF TASK OUTPUT
Q10 - FIELD OF TASK OUTPUT
SEARCH & ACQUISITION
Q12 - ACTUAL TIME TO ACQUIRE CHUNK
Q13 - DESIRED TIME TO ACQUIRE CHUNK
Q14 - LOCATION OF FIRST SOURCE
Q15 - WHY FIRST SOURCE USED
Q16 - DESIRED CLASS OF CHUNK
Q17 - ACQUISITION FROM FIRST SOURCE
Q18 - ACTUAL TRANSPORTING MEDIUM
Q19 - USUAL FORM OF TRANSPORTING MEDIUM
Q20 - DESIRED TRANSPORTING MEDIUM
Q21 - ACTUAL VOLUME OF TRANSPORTING MEDIUM
Q22 - DESIRED VOLUME OF TRANSPORTING MEDIUM
Q23 - USEFULNESS OF TITLE LISTINGS OR ABSTRACTS
Q24 - ACTUAL DETAIL OF TRANSPORTING MEDIUM
Q25 - DESIRED DETAIL OF TRANSPORTING MEDIUM
Q26 - ACTUAL LAYOUT OF TRANSPORTING MEDIUM
Q27 - DESIRED LAYOUT OF TRANSPORTING MEDIUM
Q28 - CLASS OF CHUNK
Q29 - FIELD OF CHUNK
Q30 - ESSENTIALITY OF CHUNK TO TASK
Q31 - EXTENSIVENESS OF USE OF CHUNK IN TASK

A

CQUISTION										UTILIZATION																USER										
Q 22	Q 23	Q 24	Q 25	Q 26	Q 27	Q 28	Q 29	Q 30	Q 31	Q 32	Q 33	Q 34	Q 35	Q 36	Q 37	Q 38	Q 39	Q 40	Q 41	Q 42	Q 43	Q 44	Q 45	Q 46	Q 47	Q 48	Q 49	Q 50 A	Q 50 B	Q 50 C	Q 51	Q 52	Q 53	Q 54	Q 55	Q 56
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M

RACTS

DIUM

EDIUM

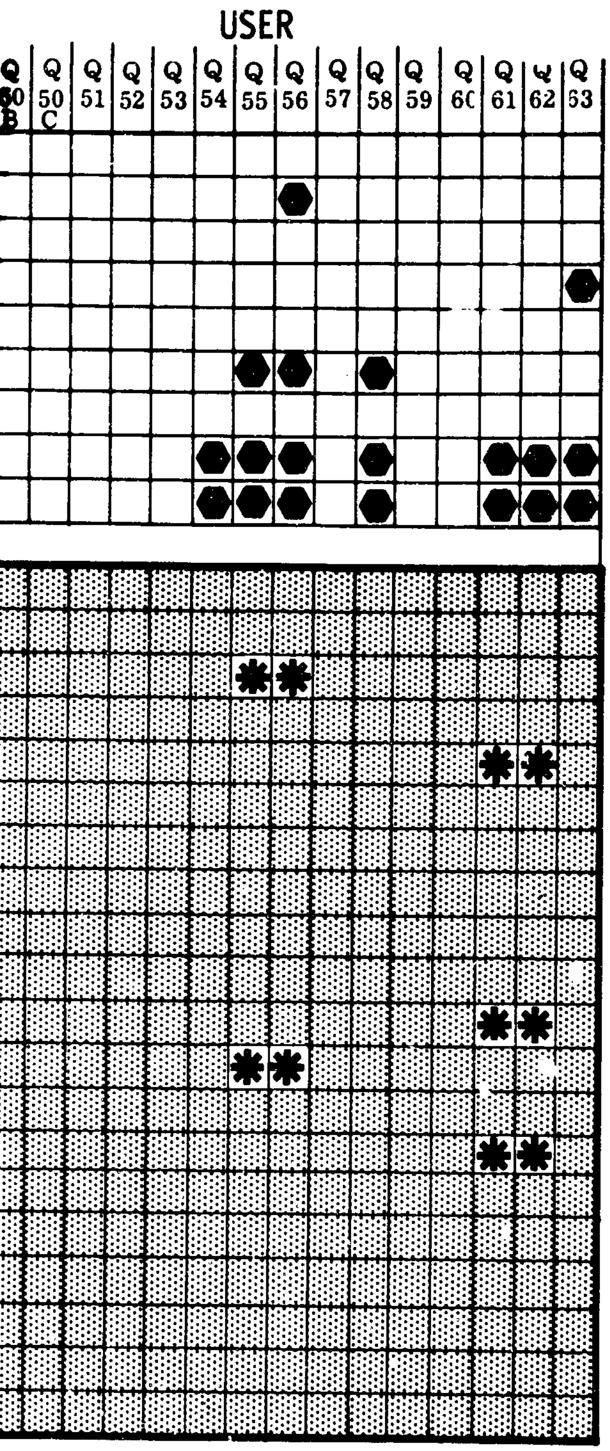
G MEDIUM

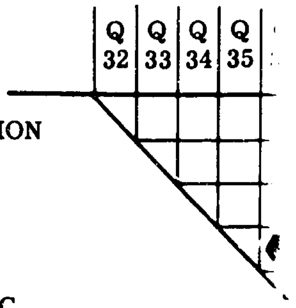
NG MEDIUM

TASK

CHUNK IN TASK

B





UTILIZATION

Q32 - DISCOVERY OF POST TASK INFORMATION
Q33 - AVAILABILITY OF A COMPANY TIC
Q34 - TIC SERVICES
Q35 - USE OF COMPANY TIC
Q36 - EVALUATION OF COMPANY TIC
Q37 - USE OF TECHNICAL ABSTRACT BULLETIN (TAB)
Q38 - USE OF SCIENTIFIC & TECHNICAL REPORTS (S
Q39 - USE OF DEFENSE DOCUMENTATION CENTE
Q40 - USE OF DOD SPECIALIZED INFORMATION
Q41 - USE OF OTHER SPECIALIZED INFORMA
Q42 - ENCOUNTER OF RESTRICTIONS
Q43 - NATURE OF RESTRICTIONS ENCOU
Q44 - USE OF ENGLISH TRANSLATIONS
Q45 - ENCOUNTER OF DIFFICULTIES
Q46 - NATURE OF DIFFICULTIES E
Q47 - POSSIBLE SOLUTION TO DI

Q

LEGEND

●	PHASE II TWO-WAY FREQUENCY DISTRIBUTIONS INVOLVING US TASK AND UTILIZATION, BUT NOT SEARCH AND ACQUISITION, QUESTIONS
✱	PHASE II TWO-WAY FREQUENCY DISTRIBUTIONS INVOLVING US TASK AND UTILIZATION QUESTIONS VS SEARCH AND ACQUISITI QUESTIONS
▨	AREA OF TWO-WAY FREQUENCY DISTRIBUTIONS INVOLVING U TASK AND UTILIZATION QUESTIONS VS SEARCH AND ACQUISIT QUESTIONS

C

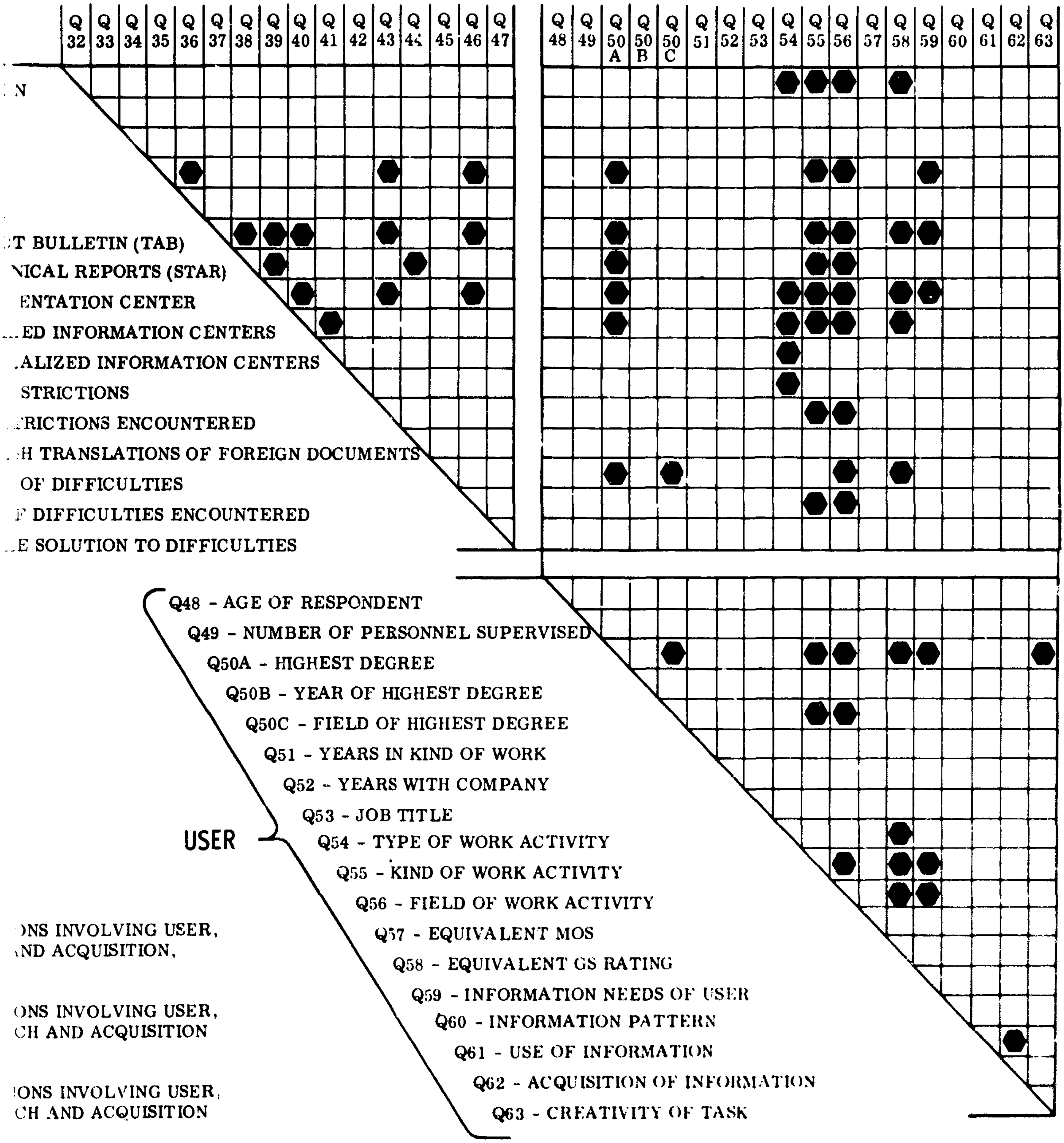


Figure A14-1. Phase II Two-Way Frequency Distributions

D

II. TWO-WAY FREQUENCY DISTRIBUTIONS INVOLVING USER, TASK AND UTILIZATION, BUT NOT SEARCH AND ACQUISITION QUESTIONS

Table A14-1. Phase II Two-Way Frequency Distributions (USER, TASK, and UTILIZATION, excluding SEARCH and ACQUISITION)

Questions	Description	χ^2	df	α	r	Remarks
Q2 vs Q7	Task Initiator vs. Task Recipient	314.05	20	$\alpha < .0005$	.040	Features of interest: a. Tasks initiated by the respondent are for his own use or go to members of his profession. b. Those generated by a decision on the part of the respondent and his colleagues are for his own use. c. The output of tasks initiated by a contractor or contractors go to the particular contractor(s).
Q3 vs Q4	Task Duration vs. Percentage of Time on Task	68.94	32	$\alpha < .0005$	-.057	A slight tendency for respondents to spend a greater percentage of their time on short tasks.
Q3 vs Q7	Task Duration vs. Task Recipient	69.38	32	$\alpha < .0005$	.094	Several interesting features are: a. Tasks of long duration are for members of the respondent's profession. b. Tasks which are for the respondent's own use vary in duration from less than one week to more than 365 days.
Q3 vs Q8	Task Duration vs. Class of Task	154.85	96	$\alpha < .0005$	-.062	There is a slight tendency for tasks to decrease in duration as the distance from nature of the class of task increases. Two notable exceptions are: a. Tasks which involve raw data tend to be short duration (less than 14 days). b. Tasks classified as experimental processes and procedures are of long duration.
Q3 vs Q9	Task Duration vs. Kind of Task	154.55	88	$\alpha < .0005$	-.182	The tendency is for tasks closer to nature to be of longer duration. Basic research tasks take the longest time, while test or evaluation, and reliability and quality control tend to be short.
Q3 vs Q10	Task Duration vs. Field of Task	108.99	64	$\alpha < .0005$	.044	Some interesting features are: a. Tasks in chemical science and materials tend to be more than 270 days in length. b. Mechanical, industrial, civil, and marine engineering tasks also tend to be long, while those in electronics and electrical engineering are of shorter duration. c. 78 percent of the tasks in mathematics required more than 30 days.
Q3 vs Q56	Task Duration vs. User's Field of Position	91.68	64	$.025 < \alpha < .01$	.057	Respondents working in the fields of chemical science and materials, and physical science perform tasks which take more than 270 days.
Q5 vs Q6	Type of Task Output vs. Formality of Task Output	324.13	24	$\alpha < .0005$	.021	Tasks in which the output is hardware tend to result in a formal briefing or demonstration, while those in which a decision is involved an informal briefing or demonstration results.

Table A-14-1. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q5 vs Q7	Type of Task Output vs. Task Recipient	93.49	24	$\alpha < .0005$	-.011	Tasks in which a finding is involved tend to go to members of the respondent's profession and decisions to all recipients except contractor(s).
Q5 vs Q8	Type of Task Output vs. Class of Task	676.80	72	$\alpha < .0005$	.105	Some of the more interesting associations are: a. Designs or design techniques result in decision and hardware. b. Test processes and procedures yield hardware or a plan. c. Performance and characteristics yield findings. d. Production processes and procedures yield recommendations or decisions.
Q5 vs Q10	Type of Task Output vs. Field of Task	199.56	48	$\alpha < .0005$	-.123	The following types of output associated with a particular field are interesting features of this interaction: a. Production, management and social science yield plan. b. Electronics and electrical engineering yield hardware. c. Physical sciences yield findings. d. Research (including computer science) yield technical data or information, and a plan. e. Mathematics yields findings.
Q5 vs Q63	Type of Task Output vs. Interviewer Assessment of Task Creativity	138.49	18	$\alpha < .0005$	-.042	Tasks involving technical data are typically assessed as being communication of existing information.
Q6 vs Q7	Formality of Task Output vs. Task Recipient	450.30	16	$\alpha < .0005$	.316	There is a strong tendency for a more formal output the further the recipient from respondent.
Q7 vs Q55	Task Recipient vs. User's Kind of Position	293.92	44	$\alpha < .0005$	-.114	The further the task from nature, the closer the task recipient is to the respondent.
Q7 vs Q56	Task Recipient vs. User's Field of Position	234.62	32	$\alpha < .0005$	-.039	There is a tendency for members of the respondents profession to receive the task output from people working in medical and physical science.
Q7 vs Q58	Task Recipient vs. User's Equivalent GS Rating	184.55	44	$\alpha < .0005$	.214	The higher the respondent's GS rating, the greater the tendency for the output of his task to go to an outside organization.
Q8 vs Q9	Class of Task vs. Kind of Task	1015.98	132	$\alpha < .0005$	.181	The following class-kind combinations exhibit a high frequency of occurrence: Class Kind Concepts Applied and basic research Math aids and computer programs Operational development systems and R&D support Designs and design techniques Operational and engineering development

Table A-14-1. (Cont)

Questions	Description	χ^2	df	a	r	Remarks
						Class — **Kind** Experimental processes and procedures — Applied and basic research Test processes and procedures — Test or evaluation Evaluation — System analysis, test or evaluation, and reliability and quality control Specifications — Engineering development, production end-items, and reliability and quality control Production processes and procedures — Production processes and production end-items Technical status — Applied research Utilization — R&D support Cost and funding and, administrative action — R&D support
Q8 vs Q10	Class of Task vs. Field of Task	719.28	96	$a < .0005$	.142	Task classes with high proportions of accompanying task fields are: a. Concepts: medical science and physical science. b. Math aids and computer programs: research (including computer science), and mathematics. c. Experimental processes and procedures: medical science and chemical science and materials. d. Evaluation: mechanical, industrial, civil, and marine engineering. e. Production processes and procedures: production management, and social sciences, and chemical science and materials. f. Technical status: medical science, and chemical science and materials. g. Cost and funding; administrative action: production, management, and social sciences and mechanical, industrial, civil, and marine engineering.
Q9 vs Q10	Kind of Task vs. Field of Task	541.39	88	$a < .0005$	-.133	Task kinds showing high proportions of accompanying fields are: a. Applied and basic research: medical science, chemical science and materials, and physical science. b. Operational development: research (including computer science).

Table A-14-1. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
						c. R&D support: research (including computer science). d. Production processes: production, management, and social science. e. Reliability and quality control: production, management and social science.
Q9 vs Q32	Kind of Task vs. Discovery of Post Task Information	23.05	11	$.025<\alpha<.01$	-.093	There is no definite trend. However, there is a high incidence of discovery of available information after task completion for basic research tasks.
Q9 vs Q54	Kind of Task vs. User's Type of Activity	149.37	44	$\alpha<.0005$	-.038	Features of interest: a. Technical evaluation: a high proportion for test and evaluation, reliability and quality control, and customer relations; and a low proportion for research. b. Scientific and engineering: a low proportion for customer relations. c. Technical management: a high proportion for reliability and quality control; and a low proportion for customer relations. d. Administrative management: a high proportion for production end-items and customer relations. e. Both technical and administrative management: a high proportion for customer relations.
Q9 vs Q55	Kind of Task vs. User's Kind of Position	4738.71	121	$\alpha<.0005$	.660	The following are the incidence of high proportion cross-overs (position to task): a. Applied research: to system analysis (24 percent); advanced development, R&D support, and test or evaluation (15 percent each). b. System analysis: to operational system development (28 percent). c. Advanced development: to engineering development (32 percent), and applied research (25 percent). d. Engineering development: to operational development (23 percent); advanced development, and test or evaluation (20 percent each). e. Operational system development: to test or evaluation (22 percent); system analysis, engineering development, R&D support, and production end-items (13 percent each). f. R&D support: to system analysis, applied research, and test or evaluation (20 percent each). g. Test or evaluation: to reliability and quality control (24 percent); applied research and system analysis (15 percent each).

Table A-14-1 (Cont)

Questions	Description	χ^2	df	a	r	Remarks
						h. Production processes: to test or evaluation (34 percent) or production end-items (19 percent). i. Production end-items: to production processes (31 percent), operational development (22 (22 percent). j. Reliability and quality control: to test or evaluation (34 percent); applied research, system analysis, and operational development (17 percent each). k. Customer relations: to R&D support (23 percent); engineering development (18 percent). The least amount of cross-over was for basic research (20 percent) and reliability and quality control (29 percent). The highest amount of cross-over was engineering development (66 percent) and customer relations (65 percent). On the average, 44 percent of the personnel crossed from a position kind to a different task kind. When kind categories are pooled as in Phase I, the cross-over rate drops to about 25 percent.
Q9 vs Q56	Kind of Task vs. User's Field of Position	580.36	88	$a < .0005$	-.135	No distinct patterns are evident. Some interesting features are: a. Production, management, and social sciences: a high proportion in production processes, reliability and quality control, and customer relations. b. Medical science: a high proportion in basic and applied research. c. Mechanical, industrial, civil, and marine engineering: a high proportion in system analysis. d. Aeronautics and space technology: a low proportion in basic research, production processes, and customer relations. e. Electronics and electrical engineering: a high proportion in operation development; and a low proportion in basic research. f. Chemical science and materials: a high proportion in basic and applied reserach, and a low proportion in systems analysis and operational development. g. Physical science: a high proportion in basic and applied research; and a low proportion in operational development. h. Research (including computer science): a high proportion in operational development.
Q9 vs Q58	Kind of Task vs. User's Equivalent GS Rating	274.28	121	$a < .0005$	-.257	Higher ratings are related to those tasks closer to nature (research). R&D support is somewhat normally distributed, with a slight loading to the low end of the scale.

Table A-14-1. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q9 vs Q61	Kind of Task vs. Interviewer Assessment of Difficulty in Use of Information	148.61	33	$\alpha < .0005$	-.244	There is a tendency for use of information to be difficult for tasks close to nature (research), and obvious or prescribed for tasks furthest from nature (customer relations). Of notable interest is the fact that tasks involving development of operational systems, methods for using the information tend to be obvious or prescribed.
Q9 vs Q62	Kind of Task vs. Interviewer Assessment of Difficulty in Acquisition of Information	75.08	22	$\alpha < .0005$	-.179	An interesting feature is that for both applied and basic research, methods for acquisition of information tends to be neither clear nor obvious.
Q9 vs Q63	Kind of Task vs. Interviewer Assessment of Task Creativity	202.91	53	$\alpha < .0005$	-.232	The closer the kind of task to nature, the more likely it involves creation of new information, systems, or hardware. Some interesting features are: a. Basic research: a high proportion in creation of new information, systems, or hardware. b. System analysis: a high proportion in extensive evaluation and analysis of existing data. c. Customer relations: a high proportion in task consisting of rearrangement of existing information, with little evaluation or analysis. d. Production processes, production end-items, and reliability and quality control: a high proportion in tasks involving only communication of existing information.
Q10 vs Q32	Field of Task vs. Discovery of Post Task Information	3.93	8	$\alpha < .0005$	.023	They are independent variables.
Q10 vs Q54	Field of Task vs. User's Type of Activity	70.16	32	$\alpha < .0005$	-.102	There is no definite trend. Features of interest: a. Technical evaluation: no medical science tasks and low in mathematical tasks. b. Scientific and engineering: no relative differences. c. Technical management: no mathematical and few production, management and social science tasks. d. Administrative management: no production, management, and social science, and mechanical, civil, industrial, and marine engineering tasks. e. Both technical and administrative management: a high proportion in production, management, and social science and medical tasks.
Q10 vs Q55	Field of Task vs. User's Kind of Position	575.01	88	$\alpha < .0005$	-.170	The field groupings show high proportions as follows: a. Production, management, and social sciences: production processes, production end-items, reliability and quality control.

Table A-14-1. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
						b. Medical sciences: research (There are entries in only research, R&D support, operational system development and system analysis). c. Mechanical, industrial, civil, and marine engineering: system analysis and customer relations. d. Aeronautics and space technology: very little basic research. e. Electronics and electrical engineering: no basic research, but high in engineering development. f. Chemical science and materials: basic and applied research. g. Physical science: basic and applied research. h. Research (including computer science): system analysis and operational development. i. Mathematics: basic and applied research.
Q10 vs Q56	Field of Task vs. User's Field of Position	5710.38	64	$\alpha < .0005$	.696	The following are the incidences of high proportional cross-over (position to task): a. Behavioral and social sciences: to mechanical, industrial, civil, and marine engineering (28%) aeronautics and space technology, and research (including computer science) (19% each). b. Medical sciences: to aeronautics and space technology (54%). c. Mechanical, industrial, civil, and marine engineering: to aeronautics and space technology 32%): electronics and electrical engineering (18%); production, management and social sciences and chemical sciences and materials (16% each). d. Aeronautics and space technology: to physical science (25%); electronics and electrical engineering, and research (including computer science) (20% each). e. Electronics and electrical engineering: to aeronautics and space technology (48%). f. Chemical sciences and materials: to aeronautics and space technology (35%), and physical science (23%). g. Physical science: to chemical sciences and materials (28%); aeronautics and space technology, and electronics and electrical engineering (20% each). h. Research (including computer science): to aeronautics and space technology (23%); physical science (17%); production, management, and social sciences and mechanical, industrial, civil, and marine engineering (13% each).

Table A-14-1. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
						1. Mathematics: to aeronautics and space technology (34%); electronics and electrical engineering (20%); chemical sciences and materials, and research (including computer science) (12% each). Cross-over was usually to aeronautics and space technology (25% of all cross-over). The least amount of cross-over was from medical sciences (13%), chemical sciences and materials (17%). The greatest amount of cross-over took place in mathematics (56%). On the average 27% of the personnel left their normal field of work for a different field of task.
Q10 vs Q58	Field of Task vs. User's Equivalent GS Rating	367.57	88	$\alpha < .0005$	-.035	The features of interest are: a. Electronic and electrical engineering has 54% of the low (GS-9) ratings. b. Medical science rated.
Q10 vs Q61	Field of Task vs. Interviewer Assessment of Difficulty in Use of Information	55.02	24	$\alpha < .0005$	.025	There is no distinct pattern. Utilization of information chunks for tasks in physical sciences tends to be difficult because methods and procedures are lacking.
Q10 vs Q62	Field of Task vs. Interviewer Assessment of Difficulty in Acquisition of Information	28.59	16	$.05 < \alpha < .025$	.022	No clear pattern exists.
Q10 vs Q63	Field of Task vs. Interviewer Assessment of Task Creativity	51.89	24	$.0005 < \alpha < .025$	.021	No distinct pattern. Tasks in the medical sciences are assessed as being creation of new information, systems or hardware.
Q32 vs Q54	Discovery of Post Task Information vs. User's Type of Activity	9.85	4	$.05 < \alpha < .025$	.071	No significant difference.
Q32 vs Q55	Discovery of Post Task Information vs. User's Kind of Position	14.61	11	$\alpha < .05$	-.050	They are independent variables. No significant difference.
Q32 vs Q56	Discovery of Post Task Information vs. User's Field of Position	3.64	8	$\alpha < .05$	.012	They are independent variables. No significant difference.
Q32 vs Q58	Discovery of Post Task Information vs. User's Equivalent GS Rating	10.71	11	$\alpha < .05$	.002	They are independent variables. No significant difference.
Q35 vs Q36	Use of Company TIC vs. Evaluation of Company TIC	877.01	12	$\alpha < .0005$	.217*	There is a tendency for those who use TIC twice or more a month to almost always find the needed information. A high proportion of those using TIC once a month seldom get what is needed.

Table A-14-1. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q35 vs Q43	Use of Company TIC vs. Nature of Restrictions	12.39	6	$\alpha<.05$	.132*	They are independent variables.
Q35 vs Q46	Use of Company TIC vs. Nature of Difficulties	7.77	6	$\alpha<.05$	.111*	They are independent variables.
Q35 vs Q50A	Use of Company TIC vs. User's Highest Degree	128.67	15	$\alpha<.0005$	.226	The higher the respondent's degree, the more frequently he used TIC. A high proportion of those with no degree never use TIC, while those with doctor's degrees use it twice or more a month.
Q35 vs Q55	Use of Company TIC vs. User's Kind of Position	224.37	33	$\alpha<.0005$	-.273	There is a moderate tendency for those performing activities close to nature to use TIC more frequently. Interesting features of this relationship are: a. Applied and basic research use TIC twice or more a month. b. Persons in test or evaluation tend to use it once a month. c. A high proportion of those in customer relations and production end-items never use TIC.
Q35 vs Q56	Use of Company TIC vs. User's Field of Position	91.99	24	$\alpha<.0005$	.065	Persons working in medical science, chemical science and materials and mathematics have a tendency to use TIC twice or more a month.
Q35 vs Q59	Use of Company TIC vs. Interviewer Assessment of Information Needs of User.	221.94	6	$\alpha<.0005$	.332	The tendency is for persons assessed as having a large information need to use TIC more frequencly than those with a lesser need.
Q37 vs Q38	Use of TAB vs. Use of STAR	839.53	16	$\alpha<.0005$	504	Those who know of and use TAB know and use STAR: 56% of those who know of TAB also know of STAR, and [illegible] of those who use TAB also use STAR.
Q37 vs Q39	Use of TAB vs. Use of DDC	497.09	8	$\alpha<.0005$	.414	Respondent's who know and use TAB tend also to know and use DDC: 87% of those who know of TAB also know of DDC, while 75% who use TAB also use DDC.
Q37 vs Q40	Use of TAB vs. Use of DOD Specialized Information Centers	118.59	8	$\alpha<.0005$	.214	The tendency is for respondents who know and use TAB to also know and use DOD Specialized Information Centers: 73% of those who know of TAB also know of the other centers, and 59% of those who use TAB also use these centers.
Q37 vs Q43	Use of TAB vs. Nature of Restrictions	60.58	8	$\alpha<.0005$	.253*	Although there is no distinct pattern, there are some interesting features: a. Respondents who do not know of TAB encounter a high proportion of proprietary restrictions. b. Those who use TAB at least once every 2 or 3 months tend to encounter both proprietary and security restrictions.
Q37 vs Q46	Use of TAB vs. Nature of Difficulties	10.45	8	$\alpha<.05$	.100*	They are independent variables.

Table A-14-1. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q37 vs Q50A	Use of TAB vs. User's Highest Degree	134.73	20	$\alpha < .0005$	.211	There is a tendency for persons with advanced degrees to know and use TAB more than persons with no degree. Both master's and doctor's degrees have a high proportion of persons who use TAB every issue or almost every issue.
Q37 vs Q55	Use of TAB vs. User's Kind of Position	184.39	44	$\alpha < .0005$	-.216	The closer the activity to nature, the greater the knowledge of and use of TAB. A high proportion of respondents engaged in test or evaluation, and production processes and procedures do not know of TAB. Of the respondents who know of TAB: a. Applied research: a high proportion use it every issue or almost every issue. b. Advanced development: a high proportion use or see it about once every 6 months. c. Basic research: a high proportion use it every issue or almost every issue, and another group who do not ever use it.
Q37 vs Q56	Use of TAB vs. User's Field of Position	51.86	32	$.025 < \alpha < .01$	.064	They are independent variables. No significant difference.
Q37 vs Q58	Use of TAB vs. User's Equivalent GS Rating	159.49	44	$\alpha < .0005$	.198	There is a tendency toward a greater knowledge and use of TAB at the higher salary levels: a. Some 73% of the sample above GS-14 know of TAB; and of these, 64% use it. b. Only 48% of those at GS-14 or below know of TAB, and 39% of these respondents actually use it.
Q37 vs Q59	Use of TAB vs. Interviewer Assessment of Information Needs of User	169.3	8	$\alpha < .0005$	.293	Respondents with large external information needs tend to know and use TAB more than those with lesser needs. However, the following features should be noted: a. Some 27% of respondents with a large need and 44% of those with moderate needs do not know of TAB. b. Some 24% of respondents with a large need and 24% of those with a moderate need know of TAB but do not use it.
Q38 vs Q39	Use of STAR vs. Use of DDC	157.30	8	$\alpha < .0005$	.243	There is a moderate tendency for those who know of and use DDC to also know of and use STAR
Q38 vs Q44	Use of STAR vs. Use of English Abstracts or Translations	74.13	4	$\alpha < .0005$	.212	No distinct patterns.
Q38 vs Q50A	Use of STAR vs. User's Highest Degree	48.60	20	$\alpha < .0005$	.112	There is a slight tendency for persons with higher degrees to know of and use STAR.

Table A-14-1. (Cont)

Questions	Description	χ^2	df	a	r	Remarks
Q38 vs Q55	Use of STAR vs. User's Kind of Position	136.78	44	$a<.0005$	-.114	Some features of interest: a. Basic research: a high proportion use STAR every issue or almost every issue. b. Advanced development: tendency to use it every 2 or 3 months and every 6 months. c. Production end-items: a high proportion never use STAR. d. Production processes: a high proportion in personnel who don't know of STAR.
Q38 vs Q56	Use of STAR vs. User's Field of Position	68.71	32	$a<.0005$	.050	There is no distinct pattern. Less than 40% of the respondents in all fields except physical sciences know of STAR. 51% of those in physical sciences know of STAR and 31% use it.
Q39 vs Q40	Use of DDC vs. Use of DOD Specialized Information Centers	163.63	4	$a<.0005$	.305	Features of interest: a. Some 19% of the respondents who know of DDC also know of the DOD Specialized Information Centers, while 60% of those who know of the centers also know of DDC. b. Some 22% of those using DDC also use these centers; and of those who use these centers, 20% also use DDC.
Q39 vs Q43	Use of DDC vs. Nature of Restrictions	57.65	1	$a<.0005$	.270*	Of the people who encounter restrictions, those who don't know of DDC encounter a high proportion of proprietary restrictions; while those using DDC tend to have both proprietary and security restrictions.
Q38 vs Q46	Use of DDC vs. Nature of Difficulties	4.02	1	$a<.05$	.137*	They are independent variables
[illegible]	Use of DDC vs. [illegible] Highest Degree	145.21	10	[illegible]	.255	Tendency toward those with higher degrees knowing of and using DDC.
Q39 vs Q54	Use of DDC vs. User's Type of Activity	42.19	8	$a<.0005$	.121	Feature of interest: a. Those with high proportion of "don't know of DDC" responses are technical evaluation and administrative management personnel.
Q39 vs Q55	Use of DDC vs. User's Kind of Position	193.95	22	$a<.0005$	-.305	There is a tendency for greater knowledge and use of DDC, the closer the position is to nature. a. Applied research: a high proportion know of and use DDC. b. Production processes, production end-items, and reliability and quality control: a high proportion do not know of DDC.
Q39 vs Q56	Use of DDC vs. User's Field of Position	46.62	16	$a<.0005$	.085	Features of interest a. "Don't know of DDC": a low proportion in mathematics. b. "Know of, but don't use": a high proportion in medical sciences, and a low proportion in mathematics. c. "Use DDC": a high proportion in mathematics, and a low proportion in medical sciences.

Table A-14-1. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q39 vs Q58	Use of DDC vs. User's Equivalent GS Rating	202.70	22	$\alpha < .0005$	.304	As GS rating increase, knowledge of and use of DDC increases
Q39 vs Q59	Use of DDC vs. Interviewer Assessment of Information Needs of User	191.40	4	$\alpha < .0005$	.305	There is a moderate tendency toward the greater the respondent's need for information, the greater his knowledge of and use of DDC.
Q40 vs Q41	Use of DOD Specialized Information Centers vs. Other Specialized Information Centers	39.12	2	$\alpha < .0005$	.171	Slight tendency for those who know of and use DOD Specialized Information Centers to also use other specialized information centers.
Q40 vs Q50A	Use of DOD Specialized Information Centers vs. User's Highest Degree	37.59	10	$\alpha < .0005$	.107	A slight linear relationship with no distinct patterns.
Q40 vs Q54	Use of DOD Specialized Information Centers vs. User's Type of Activity	38.11	8	$\alpha < .0005$	.130	Interesting features: a. Low use by medical sciences and research (including computer science) personnel. b. Medical sciences and mathematics personnel show a high proportion of those who "know of the centers, but do not use them."
Q40 vs Q55	Use of DOD Specialized Information Centers vs. User's Kind of Position	82.29	22	$\alpha < .0005$	-.071	No special pattern. Those respondents in basic research and production end-items tend to know of the centers but do not use them.
Q40 vs Q56	Use of DOD Specialized Information Centers vs. User's Field of Position	50.85	16	$\alpha < .0005$	.017	No real pattern, but slight tendency towards higher management using the centers more.
Q40 vs Q58	Use of DOD Specialized Information Centers vs. User's Equivalent GS Rating	101.81	22	$\alpha < .0005$	.197	As GS ratings go up, knowledge and use of specialized information centers rises.
Q41 vs Q54	Other Specialized Information Centers vs. User's Type of Activity	8.90	4	$\alpha < .05$	.088	They are independent variables.
Q42 vs Q54	Encounter of Restrictions vs. User's Type of Activity	11.32	1	$.005 < \alpha < .01$	.095	No distinct pattern is evident.
Q43 vs Q55	Nature of Restrictions vs. User's Kind of Position	64.54	22	$\alpha < .0005$	-.134*	Some interesting features: a. Basic research: a high incidence of security restrictions. b. Some 72 of all restriction encountered were associated with applied research, system analysis, and development.

Table A-14-1. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q43 vs Q56	Nature of Restrictions vs. User's Field of Position	27.03	16	$\alpha < .025 \quad .05$	-.068*	No distinct patterns.
Q45 vs Q50A	Encounter of Difficulties vs. User's Highest Degree	25.61	5	$\alpha < .0005$	.118	No significant pattern is evident, but there is a slight tendency for those with higher degrees to report more problems.
Q45 vs Q50C	Encounter of Difficulties vs. User's Field of Degree	18.39	13	$\alpha < .05$	.038	They are independent variables.
Q45 vs Q56	Encounter of Difficulties vs. User's Field of Position	15.69	8	$.025 < \alpha < .05$	-.010	They are independent. No significant difference, although the medical sciences do show a proportionally greater percentage of problems.
Q45 vs [illegible]	Encounter of Difficulties vs. User's Equivalent GS Rating	[illegible].82	11	$\alpha < .0005$	.101	There is a tendency for personnel with higher ratings to encounter more problems.
Q46 vs Q55	Nature of Difficulties vs. User's Kind of Position	26.30	22	$\alpha < .05$	-.095*	They are independent variables.
Q46 vs Q56	Nature of Difficulties vs. User's Field of Position	18.52	16	$\alpha < .05$	-.042*	They are independent variables.
Q50A vs Q55	User's Highest Degree vs. User's Kind of Position	621.89	55	$\alpha < .0005$	-.393	Strong tendency for persons working closest to nature to have the higher degrees. a. Applied and basic research: a high proportion of doctor's. b. Advanced development: a high proportion of master's. c. Production processes: a high proportion in respondents with no degree.
Q50A vs Q50C	User's Highest Degree vs. User's Field of Degree	1900.51	65	$\alpha < .0005$	.515	In general, the more abstract or further from the public the degree field the higher the degree. a. Physical science: a high proportion of doctor's degrees. b. Chemistry: a high proportion in respondents with doctor's degrees. c. Mechanical engineering: A high proportion in bachelor's degrees. d. Civil engineering: a high proportion in bachelor's degrees. e. Biological and medical sciences: a high proportion of doctor's. f. Humanities and social studies: a high proportion in master's degrees.
Q50A vs Q56	User's Highest Degree vs. User's Field of Position	101.[illegible]	10	$\alpha < .0005$	.097	Some interesting features are: Highest Degree — Field of Activity — % Doctor's — Chemical science and materials — 32 Physical sciences — 25 Medical sciences — 15

Table A-14-1. (Cont)

Questions	Description	χ^2	df	α	r	Remarks		
						Highest Degree	Field of Activity	%
						Professional	Chemical science and materials	38
							Production, management, and social sciences	27
						Master's	Electronics and electrical engineering	27
							Aeronautics and space technology	23
							Physical sciences	15
						Bachelor's	Electronics and electrical engineering	29
							Aeronautics and space technology	25
							Physical sciences	11
						Associate's	Electronics and electrical engineering	50
							Aeronautics and space technology	32
						No Degree	Electronics and electrical engineering	34
							Aeronautics and space technology	25
							Production, management, and social sciences	17
Q50A vs Q58	User's Highest Degree vs. User's Equivalent GS Rating	447.42	55	$\alpha < .0005$	.434	There is a strong tendency for persons with higher degrees to make more money		
						Highest Degree	GS	%
						Doctor's	GS-14 (14,000 - 16,499)	28
							GS-15 (16,500 - 18,999)	23
							GS-16 (19,000 - 20,999)	10
							GS-17 (21,000 - 23,999)	11
						Professional	GS-15 (16,500 - 18,999)	35
							GS-16 (19,000 - 20,999)	23
						Master's	GS-14 (14,000 - 16,499)	24
							GS-15 (16,500 - 18,999)	19
							GS-13 (12,000 - 13,999)	19
							GS-12 (10,250 - 11,999)	14

Table A-14-1. (Cont)

Questions	Description	χ^2	df	a	r	Remarks
						Highest Degree — GS — % Bachelor's — GS-12 (10,250 - 11,999) — 23 GS-13 (12,000 - 13,999) — 21 GS-11 (8,600 - 10,249) — 20 GS-14 (14,000 - 16,499) — 19 Associate's — GS-12 (10,250 - 11,999) — 36 GS-11 (8,000 - 10,249) — 36 No Degree — GS-11 (8,000 - 10,249) — 33 GS-12 (10,250 - 11,999) — 26 GS-13 (12,000 - 13,999) — 20
Q50A vs Q59	User's Highest Degree vs. Interviewer Assessment of Information Needs of User	141.64	10	$a < .0005$	.265	Tendency for respondents with higher degrees to have a greater information requirement.
Q50A vs Q63	User's Highest Degree vs. Interviewer Assessment of Task Creativity	107.45	15	$a < .0005$	.218	Two interesting features are: a. Doctors have a high proportion of tasks which are mostly creation of new information, systems, or hardware. b. A high proportion of respondents with no degree perform tasks which consist of communication or rearrangement of existing information with little evaluation or analysis.
Q50C vs Q55	User's Field of Degree vs. User's Kind of Position	752.20	143	$a < .0005$	-.230	Although there are no distinct patterns, the following features are of interest: a. No degree a high proportion in R&D support, test or evaluation, production processes, and production end-items; and a low proportion in applied and basic research, system analysis and advanced development. b. Behavioral and social studies a high proportion performing R&D support and system analysis, and a low proportion in advanced development, and engineering. c. Biological and medical sciences a high proportion in applied and basic research and R&D support, and a low proportion in all other kinds of position. d. General engineering a high proportion in system analysis, and a high proportion in basic research, and advanced development.

Table A-14-1. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
						e. Civil engineering: a high proportion doing advanced and engineering development, and test or evaluation; and a low proportion doing applied and basic research, production processes and reliability and quality control. f. Mechanical engineering: a high proportion in production end-items; and a low proportion in both reliability and quality control, and basic research. g. Chemical engineering: a high proportion in production processes, reliability and quality control, and public relations; and a low proportion in test or evaluation, and advanced development. h. Aeronautical engineering: a high proportion in advanced development, and test or evaluation; and a low proportion in production processes, production end-items, and operational development. i. Electrical engineering: a high proportion performing engineering and operational development; and a low proportion in basic research and production processes. j. Chemistry: a high proportion in both applied and basic research, and a low proportion in most others. k. Earth science: a high proportion in applied research and production processes; and a low proportion in production end-items, R&D support and engineering and operational development. l. Physical science: a high proportion in basic and applied research, and a low proportion in test or evaluation, production processes, production end-items, and public relations. m. Mathematical science: a high proportion in system analysis and R&D support, and a low proportion in engineering development, production processes, production end-items, and public relations.

Table A-14-1. (Cont)

[illegible]	Description	χ^2	df	α	r	Remarks
[illegible] vs	User's Field of Degree vs. User's Field of Position	2641.87	104	α<.0005	.500	There is no distinct pattern, however, the following features are of interest:

Field of Degree	High Proportion	Low Proportion
No Degree	Production, management, and social science	Medical sciences, chemical science, and mathematics
Humanities and social studies	Production, management, and social science	Medical sciences, electronics and electrical engineering, chemical science and materials, physical science, and mathematics
Biological and medical sciences	Medical sciences	All other fields
General engineering	Production, management, and social sciences	Medical sciences, and chemical science and materials
Civil engineering	Mechanical, industrial, civil, and marine engineering, aeronautics and space technology	Medical sciences, and electronics and electrical engineering
Mechanical engineering	Mechanical, industrial, civil, and marine engineering, and physical sciences	Medical sciences, electronics and electrical engineering and mathematics
Chemical engineering	Chemical science and materials, production, management, and social sciences	Medical sciences, aeronautics and space technology, electronics and electrical engineering, and mathematics
Aeronautical engineering	Aeronautics and space technology	Medical sciences, electronics and electrical engineering, chemical science and materials, research (including computer science), and mathematics
Electrical engineering	Electronics and electrical engineering	Production, management, and social sciences medical sciences, mechanical, industrial, civil, and marine engineering, chemical science and materials, and physical sciences
Chemistry	Chemical science and materials, and medical sciences	Production, management, and social sciences, mechanical, industrial, civil, and marine engineering, aeronautics and space technology, electronics and electrical engineering, research (including computer science), and mathematics
Earth sciences	Chemical science and materials	Medical sciences, aeronautics and space technology, and electronics and electrical engineering
Physical sciences	Physical sciences	Production, management, and social sciences, medical sciences, and chemical science and materials
Mathematics	Mathematics and research (including computer science)	Production, management, and social sciences, medical sciences, aeronautics and space technology, electronics and electrical engineering and chemical science and materials

Table A-14-1. (Cont)

<table>
<tr><th>Questions</th><th>Description</th><th>χ^2</th><th>df</th><th>α</th><th>r</th><th>Remarks</th></tr>
<tr><td>Q54 vs Q58</td><td>User's Type of Activity vs. User's Equivalent GS Rating</td><td>365.78</td><td>44</td><td>$\alpha < .0005$</td><td>.438</td><td>The following features are of interest:
a. Technical evaluation has the lowest ratings.
b. Scientific and engineering have a complete range of ratings, but are high in the middle range of ratings.
c. Technical management heavy in the upper middle range.
d. Administrative management is heavy in the lower middle range.
e. Both technical and administrative management dominate the upper part of the range.</td></tr>
<tr><td>Q55 vs Q56</td><td>User's Kind of Position vs. User's Field of Position</td><td>713.01</td><td>88</td><td>$\alpha < .0005$</td><td>-.199</td><td>The following table shows the important associations between kind and field of position:
<table>
<tr><th>Field of Position</th><th>High Proportion</th><th>Low Proportion</th></tr>
<tr><td>Production, management, and social sciences</td><td>Production processes, production end-items, reliability and quality control, and customer relations</td><td>Advanced and engineering development</td></tr>
<tr><td>Medical sciences</td><td>Basic and applied research</td><td>Most of the other kinds</td></tr>
<tr><td>Mechanical, industrial, civil, and marine engineering</td><td>System analysis, and customer relations</td><td>Advanced development, test or evaluation, reliability and quality control</td></tr>
<tr><td>Aeronautics and space technology</td><td>Advanced development and production end-items</td><td>Basic research and customer relations</td></tr>
<tr><td>Electronics and electrical engineering</td><td>Engineering development</td><td>Basic research and production processes</td></tr>
<tr><td>Chemical science and materials</td><td>Basic and applied research</td><td>System analysis engineering development and operational development systems, and production end-items and reliability and quality control</td></tr>
<tr><td>Physical sciences</td><td>Basic and applied research</td><td>Operational development and customer relations</td></tr>
<tr><td>Research (including computer science)</td><td>System analysis, operational development and R&D support</td><td>Production processes, production end-items, reliability and quality control</td></tr>
<tr><td>Mathematics</td><td>Applied research</td><td>Engineering and operational development, production processes, production end-items and customer relations</td></tr>
</table></td></tr>
<tr><td>Q55 vs Q58</td><td>User's Kind of Position vs. User's Equivalent GS Rating</td><td>269.98</td><td>121</td><td>$\alpha < .0005$</td><td>-.214</td><td>There is a slight tendency for respondents performing work which is closest to nature to make the most money. The following table shows the percentages of the sample within three salary ranges for each kind of position.
<table>
<tr><th>Kind of Position</th><th>% GS-6 to GS-11</th><th>% GS-12 to GS-14</th><th>% GS-15 and above</th></tr>
<tr><td>Basic research</td><td>6</td><td>50</td><td>44</td></tr>
<tr><td>Applied research</td><td>15</td><td>53</td><td>33</td></tr>
<tr><td>System Analysis</td><td>15</td><td>56</td><td>29</td></tr>
<tr><td>Advanced development</td><td>8</td><td>55</td><td>38</td></tr>
<tr><td>Engineering development</td><td>17</td><td>67</td><td>17</td></tr>
<tr><td>Operational development system</td><td>21</td><td>62</td><td>17</td></tr>
<tr><td>R&D support</td><td>28</td><td>53</td><td>20</td></tr>
<tr><td>Test or evaluation</td><td>38</td><td>56</td><td>7</td></tr>
<tr><td>Production processes</td><td>28</td><td>58</td><td>14</td></tr>
<tr><td>Production end-items</td><td>28</td><td>64</td><td>7</td></tr>
<tr><td>Reliability and quality control</td><td>25</td><td>55</td><td>20</td></tr>
<tr><td>Customer relations</td><td>8</td><td>66</td><td>28</td></tr>
</table></td></tr>
</table>

Table A-14-1. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
						Some notable features: a. Basic research: highest salaries, with 44% at GS-15 and above and only 6% below GS-12. b. Test or evaluation: lowest salaries, with 38% below GS-12 and only 7% at GS-15 and above. c. R&D support, and reliability and quality control: a high proportion both above GS-14 and below GS-12.
Q55 vs Q59	User's Kind of Position vs. Interviewer Assessment of Information Needs of User	222.41	22	$\alpha < .0005$	-.321	There is a tendency for activites closer to nature to have a larger information requirement. Both applied and basic research have a large proportion of respondents with large external information needs; while respondents in operational development, test or evaluation, production processes, and production end-items tend to have an insignificant need for such information.
Q61 vs Q62	Interviewer Assessment of Difficulty in Use of Information vs. Interviewer Assessment of Difficulty in Acquisition of Information	162.59	6	$\alpha < .0005$	.382	There is a tendency for that information which is easy to acquire to be easy to use.

*Data taken from two-way tables rather than from correlation matrix.

III. TWO-WAY FREQUENCY DISTRIBUTIONS INVOLVING USER, TASK AND UTILIZATION QUESTIONS VS SEARCH AND ACQUISITION QUESTIONS

Table A-14-2. Phase II Two-Way Frequency Distributions (USER, TASK, UTILIZATION vs. SEARCH and ACQUISITION

Questions	Description	χ^2	df	α	r	Remarks
Q12 vs Q3	Actual Acquisition Time vs. Task Duration	1245.30	48	$\alpha < .0005$	.375	As could be expected, the longer tasks utilized more time to acquire information. The use of recall is basically stable regardless of task length, although there is a higher proportion for tasks of one week or less.
Q12 vs Q13	Actual Acquisition Time vs. Desired Acquisition Time	7786.22	30	$\alpha < .0005$	.684	In general, only 5% of the information was not received within the desired time limit. Also 33% of the information was received before the time requirement.
Q12 vs Q14	Actual Acquisition Time vs. Location of First Source for Information	2823.63	84	$\alpha < .0005$	.240	The greater the retrieval time, the more distant the first source.
Q12 vs Q21	Actual Acquisition Time vs. Actual Volume of Information Media	2490.41	18	$\alpha < .0005$	.215	There is a tendency for more volume of information to be related to longer acquisition time. Items of interest: a. Acquisition in less than one day has a high proportion of one report item. b. Some 29% of those who received data in less than 1 day, reported that they received all available and pertinent information. c. A sampling of available information is related to longer acquisition time. d. All information available shows no effect of acquisition time, except for being low in recall.
Q12 vs Q24	Actual Acquisition Time vs. Actual Depth of Information Media	191.52	12	$\alpha < .0005$	.006	There is a slightly higher proportion of recall responses that are related to specific answers (65% for recall and 51% for the population).
Q12 vs Q28	Actual Acquisition Time vs. Class of Information	368.99	72	$\alpha < .0005$	.045	No pattern. High proportion features: a. Recall: a high proportion for concepts, math aids and computer programs, test processes and procedures, and utilization; and a low proportion for raw data. b. Less than 1 day: a high proportion for specifications. c. Over 30 days: technical status.
Q12 vs Q29	Actual Acquisition Time vs. Field of Information	126.42	48	$\alpha < .0005$	-.018	No pattern. Features of interest: a. Recall: a high proportion for mathematics. b. Over 30 days: a high proportion for medical sciences. c. Less than 1 day: a low proportion for medical sciences.
Q13 vs Q9	Desired Acquisition Time vs. Kind of Task	335.31	55	$\alpha < .0005$	-.154	The closer to nature the task, the more time allowed to get information: High and low proportion features: a. Recall: basic research high; production low. b. Less than 1 day: test or evaluation high; basic research low. c. 1-7 days: basic and applied research low. d. 8-30 days: basic research low. e. 30-90 days: customer relations, reliability and quality control, and basic research high. f. Over 90 days: basic and applied research high. g. Production: production processes and end-items, reliability and quality control h. Technical status: customer relations

Table A-14-2. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q13 vs Q14	**Desired Acquisition Time vs. Location of First Source for Information**	1900.87	70	$\alpha<.0005$	.177	As the time allowed to acquire information goes up, the first source has a tendency to be farther from the respondent. Features of interest: a. Received with task assignment associated with less than 1 day. b. Respondent's own action associated with longer acquisition time (over 90 days). c. Internal company consultant associated with longer acquisition times (31-90 days). d. Company library associated with tasks lasting over 1 week. e. External consultant, DOD information systems and customer associated with longer acquisition times.
Q13 vs Q16	Desired Acquisition Time vs. Desired Class of Information	246.34	65	$\alpha<.0005$	.022*	No pattern. Features of interest: a. Recall: a high proportion for math aids and computer programs, experimental processes and procedures, test processes and procedures, evaluation, and utilization. b. Less than 1 day: a high proportion for test processes and procedures and specifications. c. Long lead time: technical status and experimental processes and procedures.
Q13 vs Q19	Desired Acquisition Time vs Usual Composition of Information Media	18.56	10	$.025<\alpha<.05$	.017	They are independent.
Q13 vs Q22	Desired Acquisition Time vs. Desired Volume of Information Media	1734.01	15	$\alpha<.0005$	.227	The length of time allowable is greater when a greater volume of information is desired.
Q13 vs Q25	Desired Acquisition Time vs. Desired Depth of Information Media	60.20	10	$\alpha<.0005$	.061	No pattern. Recall low for detailed analysis.
Q14 vs Q3	Location of First Source for Information vs. Task Duration	337.48	112	$\alpha<.0005$	.065	The tendancy is towards longer tasks using first sources that are more distant from the individual seeking information. High proportion features: a. Received with task assignment: 1-7 days b. Recalled it: 1-7 days c. Respondent's own action: 181-270 days d. External consultant: 91-180 days, 181-270 days e. DOD information systems: 270-365 days, 15-21 days f. Customer: 21-30 days, 31-90 days
Q14 vs Q9	Location of First Source for Information vs. Kind of Task	500.13	154	$\alpha<.0005$	.011	High proportion features: a. Own collection: basic research b. Asked colleague: customer relations c. Asked supervisor: R&D support d. Department files: operation system development e. Internal company consultant: production end-items, reliability and quality control f. Library: basic and applied research g. Manufacturer, vendor or supplier: production processes h. Customer: system analysis

Table A-14-2. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q14 vs Q10	Location of First Source for Information vs. Field of Task	390.37	112	$\alpha < .0005$	-.026	High proportion features: a. Respondent's own action: mechanical, industrial, civil, and marine engineering. b. Assigned subordinate to get it: production, management, and social sciences; and mathematics. c. Ask a colleague: mathematics, research and research equipment. d. Library: chemical sciences. e. External consultant: medical sciences. f. DOD services: mechanical, industrial, civil, and marine engineering.
Q14 vs Q15	Location of First Source for Information vs. Why Used First Source for Information	6434.87	70	$\alpha < .0005$	.119	Features of interest: a. Available or easy to use: a high proportion from recall and own collection. b. Found helpful previously: a high proportion from subordinate, company library, and supervisor. c. Most authoritative: a high proportion from colleague, internal consultant, manufacturer or supplier, external consultant, DOD information system, and customer. d. Only source known: a high proportion from respondent's own action, manufacturer or supplier, and customer. e. Told or knew information was available from source: a high proportion from recall and department files.
Q14 vs Q16	Location of First Source for Information vs. Desired Class of Information	807.77	182	$\alpha < .0005$	.009*	No pattern. Features of interest: a. Received with task: a high proportion for specifications. b. Recall: a high proportion for concepts, test processes and procedures, evaluation, and utilization. c. Own collection: a high proportion for math aids and computer programs. d. Respondent's own action: a high proportion for experimental processes and procedures, and evaluation. e. Asked subordinate: a high proportion for evaluation, production processes and procedures, cost and funding, and administration. f. Colleague: a high proportion for utilization. g. Supervisor: a high proportion for request for information source production processes and procedures. None for concepts, math aids and computer programs or experimental processes and procedures. h. Department files: a high proportion for technical status. i. Company consultant: a low proportion for raw data, math aids and computer programs, experimental processes and procedures, and technical status. j. Company library: a high proportion for request for information source, concepts, and technical status. k. Manufacturer, vendor or supplier: none in raw data, experimental processes and procedures. l. Customer: none for concepts or production processes and procedures.

Table A-14-2. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q14 vs Q17	Location of First Source for Information vs. Acquisition from First Source for Information	355.63	56	$\alpha < .0005$	-.076	Some 47% of cases received all information required from the first source. No significant differences within first source for "all information needed" or "part of the information". Best first sources: assigned a subordinate to get it (67% for "all the information needed") and received with task (62% for "all the information needed"). Worst first sources: supervisor (29% for "all the information needed") and libraries (34% for "all the information needed"). High proportion features: a. Irrelevant inappropriate information: library, DOD information systems, and customer. b. Nothing: supervisor, library, external consultant, and customer. c. Reference to another source: colleague, supervisor, and library.
Q14 vs Q22	Location of First Source for Information vs. Desired Volume of Information Media	1825.99	42	$\alpha < .0005$	.201	Features of interest: a. Some 34% of those who used recall as first source received all their information from recall. b. Only 7% of those who received all of their information from recall used another source as the first source -- all being from the local work environment. c. One report or document has a relatively high proportion that was received with the task, or went to the supervisor or customer. d. Sampling has a low proportion that was received with the task or went to the customer or external consultant. e. All information available has a high proportion that went to company libraries.
Q14 vs Q24	Location of First Source for Information vs. Actual Depth of Information Media	148.53	28	$\alpha < .0005$	-.021	No pattern. Once over lightly is high for respondent's own action and low for department files and outside libraries.
Q14 vs Q25	Desired Depth of Information Media vs. First Source for Information	87.94	28	$\alpha < .0005$	.046	There is no apparent pattern.
Q14 vs Q28	Location of First Source for Information vs. Class of Information	1028.65	168	$\alpha < .0005$	.084	High proportion features: a. Received with task: specifications. b. Recalled: concepts, math aids and computer programs, test processes and procedures. c. Searched own collection: math aids and computer programs. d. Respondent's own action: experimental processes and procedures, and raw data. e. Assigned subordinate to get it: technical status, cost and funding, experimental processes and procedures, and evaluation. f. Asked a colleague: math aids and computer programs. g. Asked supervisor: production process and procedures, and specifications. h. Library: experimental processes and procedures. i. External consultant: technical status, raw data, and utilization. j. DOD information systems: technical status and cost and funding. k. Asked customer: cost and funding.

Table A-14-2. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q14 vs Q55	Location of First Source for Information vs. User's Kind of Position	431.77	154	$\alpha < .0005$	.013	No pattern. Features of interest: a. Basic research: a high proportion for recall, respondent's own action, own collection, and use of company libraries. None for supervisor or customer; and a low proportion for department files, company consultant and manufacturer, vendor or supplier. b. Applied research: a high proportion for DOD centers. c. System analysis: a high proportion for external consultant and supervisor. d. Operational system development: a high proportion for DOD information centers. e. Production processes: a high proportion for manufacturer, vendor or supplier and subordinate. f. Production end-items: a high proportion for company consultant. g. Customer relations: a high proportion for outside library.
Q14 vs Q56	Location of First Source for Information vs. User's Field of Position	330	112	$\alpha < .0005$	.004	No pattern. Features of interest: a. Behavorial and social science: a high proportion for subordinates. b. Medical sciences: a high proportion for outside libraries, external consultants, recall and respondent's own action. c. Mechanical, industrial, civil, and marine engineering: a high for respondent's own action and DOD information centers. d. Aeronautics and space technology: a low proportion for respondent's own action and external consultant. e. Electronics and electrical engineering: a low proportion for outside libraries. f. Chemical sciences: a high proportion for company libraries and external consultants. g. Research and research equipment: a high proportion for external consultants and customer, and a low proportion for department files, subordinates and supervisor. h. Mathematics: a high proportion for colleagues and company libraries, a low proportion for subordinates, department files, and manufacturer, vendors and supplies; none for respondent's own action, outside library and customer.
Q15 vs Q17	Why Used First Source for Information vs. Acquisition from First Source for Information	211.43	20	$\alpha < .0005$	.046	No pattern. Features of interest: a. Received with task: highest for received all information needed from first source although some 3% of the information that received information with the task needed additional data. b. Availability a high proportion for getting nothing from first source. c. Helpful previously: a high proportion for irrelevant or inappropriate information and reference to another source.

Table A-14-2. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q16 vs Q5	Desired Class of Information vs. Type of Task Output	348.21	78	$\alpha < .0005$	.051*	No pattern. Features of interest: a. Hardware: a high proportion for experimental processes and procedures; and a low proportion for raw data, requested information source, and utilization. b. Design: a high proportion for design; and a low proportion for raw data and experimental processes and procedures. c. Finding: a high proportion for experimental processes and procedures, math aids and computer programs, and raw data. d. Recommendation: a high proportion for concepts. e. Decisions: a low proportion for technical status and request for information source; none for performance and characteristics and production processes and procedures. f. Plan: a high proportion for cost and funding, and administrative action, and production processes and procedures.
Q16 vs Q8	Desired Class of Information vs. Class of Task	1168.03	156	$\alpha < .0005$	.089*	Due to the fact that the class of information is made up of three sub-sets of tasks (i.e., there are three information chunks per task for Question 16), no meaningful pattern is evidenced.
Q16 vs Q10	Desired Class of Information vs. Field of Task	714.55	104	$\alpha < .0005$	-.054*	No pattern. Features of interest: a. Concepts: a high proportion for physical science; none for mechanical, industrial, civil, and marine engineering. b. Raw data: a high proportion for physical sciences and research and engineering; none for mathematics. c. Math aids and computer programs: a high proportion for research and research equipment, and mathematics. d. Design: a low proportion for chemical sciences. e. Experimental processes and procedures: a high proportion for medical sciences and mathematics; and a low proportion for aeronautics and space technology, and electronics and electrical engineering. f. Test processes and procedures: a low proportion for behavioral and social sciences, and medical sciences, and none for mechanical industrial, civil, and marine engineering g. Production processes and procedures: a high for behavioral and social sciences, and chemical sciences; none for medical sciences and mathematics. h. Technical status: a high proportion for medical sciences and chemical sciences. i. Utilization: a high proportion for medical sciences, and research and research equipment. j. Cost and administrative action: a high proportion for behavioral and social sciences, and mechanical, industrial, civil, and marine engineering.

Table A-14-2. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q16 vs Q17	Desired Class of Information vs. Acquisition from First Source for Information	281.51	52	$\alpha < .0005$	.028*	There is no apparent pattern. Features of interest: a. Irrelevant or inappropriate information: a high proportion for requested information source, concepts, and utilization; none for raw data, experimental processes and procedures, designs or design techniques, evaluation and production processes and procedures. b. Nothing: a high proportion for requested information source, math aids and computer programs; none for experimental processes and procedures, evaluation, and utilization. c. A reference to another source: a high proportion for requested information source, math aids and computer programs, and technical status; none for experimental processes and procedures, and raw data. d. Part of information: no outstanding features. e. All information needed: a high proportion for raw data.
Q16 vs Q21	Desired Class of Information vs. Actual Volume of Information Media	259.31	39	$\alpha < .0005$	.070*	There is no pattern. Features of interest: a. All from recall: a high proportion for utilization, evaluation, test processes and procedures, math aids and computer programs; and a low proportion for concepts and technical status. b. One report or document: a high proportion for specifications; and a low proportion for requested information source, concepts, and technical status. c. A sampling: a high proportion for technical status. d. All pertinent information: no unique characteristics.
Q16 vs Q22	Desired Class of Information vs. Desired Volume of Information Media	230.56	39	$\alpha < .0005$	.012*	No apparent pattern. Features of interest: a. All from recall: a high proportion for test processes and procedures, evaluation, utilization, math aids and computer programs; and a low proportion for technical status. b. One report: a high proportion for specifications; and a low proportion for concepts and experimental processes and procedures.
Q16 vs Q23	Desired Class of Information vs. Usefulness of Title Listings or Abstracts	308.02	26	$\alpha < .0005$	.014*	No apparent pattern. Features of interest: a. Not applicable: a high proportion for raw data b. Would have been useful: concepts, and experimental processes and procedures. c. Used: A high proportion for requested information source, experimental processes and procedures, concepts, technical status, and a low proportion for cost and administrative action.

Table A-14-2. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q16 vs Q24	Desired Class of Information vs. Actual Depth of Information Media	96.46	26	<.0005	-.003*	There is no pattern. Only features of interest are that requested information source is high in proportion to once-over-lightly and experimental processes and procedures is high for detailed analysis.
Q16 vs Q25	Desired Class of Information vs. Desired Depth of Information Media	69.73	26	<.0005	-.022*	There is no apparent pattern. Features of interest: a. Once-over-lightly: a high proportion for technical status. b. Specific answer: no unique features. c. Detailed analysis: a high proportion for concepts and experimental processes and procedures.
Q16 vs Q26	Desired Class of Information vs. Actual Layout of Information Media	632.10	208	<.0005	.004*	There is no apparent pattern. Features of interest: a. Requested information source: a high proportion for telephone; photos; and graphics and text. b. Concepts: a high proportion for narrative text, and graphics and text. c. Raw data: a high proportion for graphics, tables or lists; and graphics and lists. d. Math aids and computer programs: a high proportion for narrative text; and graphics, text, oral, and recall. e. Design: a high proportion for graphics. f. Experimental processes and procedures: a high proportion for recall; and graphics, text, oral and recall. g. Test processes and procedures: a high proportion for recall; and graphics, text, oral and recall. h. Evaluation: a high proportion for recall. i. Specifications: narrative text. j. Performance and characteristics: formal briefings; slides and motion pictures; and microfilm. k. Production processes and procedures: a high proportion for telephone, narrative text, tables and lists; photos and text, and graphics, text, oral and recall. l. Utilization: a high proportion for recall, and group discussion. m. Cost and administrative action: telephone; tables and lists; narrative text, tables and lists; and photos and text. n. Those physical layouts which were not received for certain classes are: 1. Telephone: none for concepts, raw data, math aids and computer programs, and experimental processes and procedures. 2. Group discussions: none for raw data. 3. Graphics: none for experimental processes and procedures.

Table A-14-2. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q16 vs Q26 (Cont)						4. Narrative text, tables and lists: none for request and information source; concepts; raw data; and experimental processes and procedures. 5. Graphics and lists: none for raw data; and experimental processes and procedures. 6. Photos and text: none for math aids and computer programs; test processes and procedures.
Q16 vs Q27	Desired Class of Information vs. Desired Layout of Information Media	639.35	208	$\alpha<.0005$	.015*	There is no apparent pattern. Shows the same relationships as Q16 vs Q26.
Q16 vs Q28	Desired Class of Information vs. Class of Information	3617.45	156	$\alpha<.0005$	.091*	A pattern exists, but it is an unexpectedly weak one. The dominant features of the table relate to class of request that match the class of task, but the proportions in evidence are not very high. This shows that if an individual is seeking a certain class of information, he does not necessarily -- or even in the majority of cases -- ask for the class of information, but for some subset or component class. For example, information of the concept class had only 9% of their associated request to first source class interpreted as concepts, while 20% of the requests were for performance and characteristics data and 18% for technical status.
Q16 vs Q29	Desired Class of Information vs. Field of Information	1297.95	104	$\alpha<.0005$	-.080*	There is no definite pattern. Features of interest: a. Behavioral and social sciences: a high proportion for production processes and procedures, and cost and administrative action. b. Medical sciences: a high proportion for requested information source, experimental process and procedure, utilization: none for concepts, raw data, or production processes and procedures. c. Mechanical, industrial, civil, and marine engineering: a high proportion for cost and administrative action. d. Aeronautics and space technology: a low proportion for experimental and production processes and procedures. e. Electronics and electrical engineering: a low proportion for math aids and computer programming. f. Chemical sciences and materials: a high proportion for production processes and procedures, and a low proportion for math aids and computer programs. g. Physical sciences: a high proportion for concepts and raw data. h. Research and research equipment: a high proportion for math aids and computer programs, experimental processes and procedures, and utilization. i. Mathematics: a high proportion for math aids and computer program, evaluation, utilization, experimental processes and procedures, and concepts.

Table A-14-2. (Cont)

Questions	Description	χ^2	df	*a*	r	Remarks
Q16 vs Q32	Desired Class of Information vs. Discovery of Post Task Information	9.70	13	<.05	.006*	They are independent.
Q16 vs Q61	Desired Class of Information vs. Interviewer Assessment of Difficulty in Use of Information	144.82	39	*a*<.0005	-.017*	There is no pattern. Features of interest: a. Obvious or prescribed: a high proportion for design or design techniques. b. Independent of professional judgment: a high proportion for production processes and procedures, and cost and administrative action. c. Dependent upon professional judgment: no outstanding features, although concepts has the highest proportion. d. Difficult: a high proportion for concepts, and math aids and computer programs.
Q16 vs Q62	Desired Class of Information vs. Interviewer Assessment of Difficulty in Acquisition of Information	90.98	26	*a*<.0005	-.041*	There is no pattern. Features of interest: a. Clear or obvious: a high proportion for raw data; and a low proportion for concept. b. Fairly clear or obvious: a high proportion for concepts, and math aids and computer programs; a low proportion for utilization.
Q17 vs Q22	Acquisition from First Source for Information vs. Desired Volume of Information Media	713.30	12	*a*<.0005	-.279	There is a tendency for the greater the desired volume, the less the amount received from the first source. Recall and one report or document has a proportion of "received all the information needed." A sampling has a high proportion of "part of the information" and a "reference to another source." A unique characteristic is that 57% of those who reported they received irrelevant or inappropriate information from the first source ended up with all the information that could be found pertinent to the subject.
Q17 vs Q25	Acquisition from First Source for Information vs. Desired Depth of Information Media	47.41	8	*a*<.0005	-.051	There is no pattern. Only feature of interest: Once-over-lightly is high for "received nothing" and a "reference to another source."
Q21 vs Q22	Actual Volume of Information Media vs. Desired Volume of Information Media	10392.48	9	*a*<.0005	.826	Interesting features: a. Some 96% of those who desired information by recall or sampling received it in that manner. b. Some 79% of those desiring information in one report or document received it in that manner -- with 17% of the data from a sampling. c. Some 68% of those desiring all the material available acquired this depth of information -- with 29% receiving only a sampling.
Q21 vs Q24	Actual Volume of Information Media vs. Actual Depth of Information Media	385.72	6	*a*<.0005	.049	No apparent pattern exists. Features of interest: a. All from recall: a high proportion for a specific answer. b. One report: no outstanding feature. c. A sampling: a high proportion for a once-over-lightly. d. All reports pertinent: a low proportion for a once-over-lightly.

Table A-14-2. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q21 vs Q26	Actual Volume of Information Media vs. Actual Layout of Information Media	2627.57	48	$\alpha < .0005$	.232	The greater the depth, the more formal the layout. Features of interest: a. One report or document: a high proportion of telephone, table or list, and narrative text. b. Sampling: a high proportion of graphic, text and oral: and graphics text, oral and recall. c. All material available: no outstanding features.
Q21 vs Q27	Actual Volume of Information Media vs. Desired Layout of Information Media	2839.51	68	$\alpha < .0005$	.243	Same basic pattern and characteristics as Q21 vs Q26.
Q21 vs Q28	Actual Volume of Information Media vs. Class of Information	340.98	36	$\alpha < .0005$	.006	There is no pattern. Features of interest: a. Recall: a high proportion for experimental processes and procedures, specifications, performance and characteristics, and utilization; and a low proportion for design and design techniques, production processes and procedures, cost and administrative action. b. One report: a high proportion for production processes and procedures. c. A sampling: a low proportion for production processes and procedures. d. All pertinent information: no outstanding relationship.
Q21 vs Q29	Actual Volume of Information Media vs. Field of Information	57.77	24	$\alpha < .0005$	-.031	There is no pattern. Only feature of interest: All from recall is high for research and research equipment, and mathematics.
Q21 vs Q30	Actual Volume of Information Media vs. Essentiality of Information	65.01	9	$\alpha < .0005$	.056	No pattern. Only high proportions: a. Recall high for "somewhat helpful". b. One report high for "neither helpful or essential."
Q21 vs Q31	Actual Volume of Information Media vs. Extensiveness of Information Use	102.34	15	$\alpha < .0005$	.028*	There is no apparent pattern. There are no outstanding features.
Q22 vs Q5	Desired Volume of Information Media vs. Type of Task Output	168.87	18	$\alpha < .0005$	.010	There is no pattern. Only feature of interest is technical data which is high for all from recall and low for sampling.
Q22 vs Q9	Desired Volume of Information Media vs. Kind of Task	188.14	33	$\alpha < .0005$	-.045	There is no pattern. Features of interest: a. One report: a high proportion for customer relations; a low proportion for basic research. b. Sampling: a high proportion for basic research. c. All pertinent information: a high proportion for production end-items.
Q22 vs Q10	Desired Volume of Information Media vs. Field of Task	47.27	24	$.001 < \alpha < .005$	-.015	They are independent.
Q22 vs Q23	Desired Volume of Information Media vs. Usefulness of Title Listings or Abstracts	563.51	6	$\alpha < .0005$	.249	As more volume is desired, there is a tendency to use title listings or abstracts more.

Table A-14-2. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q22 vs Q25	Desired Volume of Information Media vs. Desired Depth of Information Media	141.38	6	$\alpha < .0005$	.078	Interesting features: a. All from recall: a high proportion of specific answers: a low proportion of detailed analysis. b. A sampling of reports: a high proportion of once-over-lightly; a low proportion of specific answers.
Q22 vs Q27	Desired Volume of Information Media vs. Desired Layout of Information Media	2710.91	48	$\alpha > .0005$	.254	Same pattern as Q21 vs. Q26 and Q21 vs. Q27.
Q22 vs Q28	Desired Volume of Information Media Class of Information	329.28	36	$\alpha > .0005$	-.002	There is no linear relationship. Although there is a significant difference between breadth desired and received in Phase II, their relationship to class of information is relatively the same.
Q22 vs Q32	Desired Volume of Information Media vs Discovery of Post Task Information	63.76	3	$\alpha > .0005$	.101	There is a slight tendency for those desiring more volume to discover post task information. but there are no outstanding features.
Q22 vs Q61	Desired Volume of Information Media vs. Interviewer Assessment of Difficulty in Use of Information	51.63	9	$\alpha > .0005$	.070	There is no pattern and no outstanding characteristics.
Q22 vs Q62	Desired Volume of Information Media vs. Interviewer Assessment of Difficulty in Acquisition of Information	47.46	6	$\alpha > .0005$	.040	There is no pattern and no outstanding characteristics.
Q23 vs Q9	Usefulness of Title Listings or Abstracts vs. Kind of Task	274.91	22	$\alpha > .0005$	-.169	There is a tendency for those individuals on tasks farthest removed from nature (research) to use title listings and abstracts less. Use of title listings or abstracts has a high proportion of basic and applied research.
Q23 vs Q10	Usefulness of Title Listings or Abstracts vs. Field of Task	94.60	18	$\alpha > .0005$	.010	There is no pattern. Only unique feature is that medical science personnel reported a high proportion of use.
Q23 vs Q25	Usefulness of Title Listings or Abstracts vs. Desired Depth of Information Media	154.30	4	$\alpha > .0005$	.024	There is a tendency for those who desired a detailed analysis to use title listings and abstracts more often.
Q23 vs Q55	Usefulness of Title Listings or Abstracts vs. User's Kind of Position	246.35	22	$\alpha > .0005$	-.134	Same pattern as Q23 vs Q9.
Q23 vs Q56	Usefulness of Title Listings or Abstracts vs. User's Field of Position	98.64	16	$\alpha > .0005$	.025	Same pattern as Q23 vs Q10.
Q24 vs Q25	Actual Depth of Information Media vs. Desired Depth of Information Media	5382.95	4	$\alpha > .0005$	.692	The user usually gets the depth he desires (79% - 95%). If he gets a specific answer or detailed analysis, he usually wants this depth of information (96% and 92%, respectively). However, "once-over-lightly" information was desired in this form only 39% of the time.
Q24 vs Q26	Actual Depth of Information Media vs. Actual Layout of Information Media	468.56	32	$\alpha > .0005$	.058	There is no pattern. Features of interest: a. Once-over-lightly: a high proportion for photo and text; graphics, text, oral and recall; and formal briefings; and a low proportion for graphics; graphics and lists.

Table A-14-2. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q24 vs Q26 (Cont)						b. Specific answer: a high proportion for telephone: and a low proportion for graphics, text, oral and recall. c. Detailed analysis: a low proportion for telephone; group discussion; and informal briefings. None for photographs.
Q24 vs Q27	Actual Depth of Information Media vs. Desired Layout of Information Media	367.56	32	$\alpha<.0005$	.058	There is no pattern.
Q24 vs Q28	Actual Depth of Information Media vs. Class of Information	114.55	24	$\alpha<.0005$	-.036	There is no linear relationship There is no pattern. A proportional distribution is evidenced throughout, but concepts are low for specific answers.
Q24 vs Q29	Actual Depth of Information Media vs. Field of Information	28.49	16	$\alpha<.025$ $\alpha<.05$	.011	They are independent.
Q24 vs Q30	Actual Depth of Information Media vs. Essentiality of Information	217.64	6	$\alpha<.0005$	.121	The greater the depth desired, the more the likelihood that the data will be considered essential or extremely helpful.
Q24 vs Q31	Actual Depth of Information Media vs. Extensiveness of Information Use	308.51	10	$\alpha<.0005$	.182*	The greater the depth desired, the more the likelihood that the data will be used throughout the task or in a major portion of the task.
Q25 vs Q3	Desired Depth of Information Media vs. Task Duration	22.41	16	$\alpha<.05$	.045	They are independent.
Q25 vs Q5	Desired Depth of Information Media vs. Type of Task Output	44.69	12	$\alpha<.0005$	.035	There is no pattern. Only feature is that hardware is high for once-over-lightly.
Q25 vs Q8	Desired Depth of Information Media vs. Class of Task	94.57	24	$\alpha<.0005$	-.022	There is no pattern. Only feature is that utilization, and cost and administrative action are high for once-over-lightly.
Q25 vs Q9	Desired Depth of Information Media vs. Kind of Task	103.84	22	$\alpha<.0005$	-.088	There is a slight trend which indicates that the farther from nature the kind of task, the less depth is desired. High proportion features: a. Once-over-lightly: customer relations, reliability and quality control, and test or evaluation b. Specific answer: no significant differences. c. Detailed analysis: basic research
Q25 vs Q10	Desired Depth of Information Media vs. Field of Task	54.99	16	$\alpha<.0005$	-.024	There is no pattern. Only feature is that medical science is high for detailed analysis and low for once-over-lightly.
Q25 vs Q27	Desired Depth of Information Media vs. Desired Layout of Information Media	335.58	32	$\alpha<.0005$	.114	There is no apparent pattern. Features of interest: a. Once-over-lightly: a high proportion for graphics, text, oral and recall: and informal briefings. b. Specific answer: a high proportion for telephone. c. Detailed analysis. none for photographs.
Q25 vs Q32	Desired Depth of Information Media vs. Discovery of Post Task Information	12.39	2	$.001<$ $\alpha<.0005$	.017	They are independent.

Table A-14-2. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q25 vs Q61	Desired Depth of Information Media vs. Interviewer Assessment of Difficulty in Use of Information	23.62	6	$.001 < \alpha < .0005$	.055	They are independent.
Q25 vs Q62	Desired Depth of Information Media vs. Interviewer Assessment of Difficulty in Acquisition of Information	43.17	4	$\alpha < .0005$	.089	There is no pattern or feature of interest.
Q26 vs Q27	Actual Layout of Information Media vs. Desired Layout of Information Media	50873.39	256	$\alpha < .0005$	.863	Features of interest: a. The layouts containing oral communications (telephone, informal briefings, group discussion, and combinations including oral information) have an actual to desired proportion of only 60%, and a desired to actually received proportion of about 90%. b. The more formal layouts (graphics, text, lists, and combinations) have an actual to desired proportion of about 90% and a desired to actual proportion of about 80%. c. Recall was actually received 97% of the time desired, and desired 92% of the time actually received. d. The low occurrance layouts (photos, slides, micro-form and formal briefings) are usually desired when received, but have low actually received when desired proportions.
Q26 vs Q28	Actual Layout of Information Media vs. Class of Information	1266.06	192	$\alpha < .0005$	.081	There is no apparent pattern. Outstanding features: a. Recall: a high proportion for concepts, math aids and computer programs, test processes and procedures, experimental processes and procedures, evaluation, utilization, and production processes and procedures. b. Telephone conversation: production processes and procedures, technical status, utilization, cost and administrative action. c. Group discussion: concepts, evaluation, costs, and administrative action. d. Photographs (N of 8) used only for concepts, raw data, test processes and procedures, and performance and characteristics. e. Graphics: a high proportion for design; and a low proportion for concepts, math aids and computer programs, evaluation, experimental processes and procedures, production processes and procedures, technical status, and utilization. f. Tables or lists: a high proportion for raw data, math aids and computer programs, and cost and administrative action.

Table A-14-2. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q26 vs Q28 (Cont)						g. Narrative text: a high proportion for design or design techniques, specifications, and technical status: and a low proportion for performance and characteristics. h. Narrative text and tables or lists: a high proportion for test processes and procedures, specifications, production processes and procedures, and cost and administrative action: none for evaluation. i. Graphics and lists: a high proportion for raw data and specifications: and a low proportion for concepts, test processes and procedures, production processes and procedures, and utilization. j. Photographs and text: a high proportion for performance and characteristics: none for math aids and computer programs. k. Graphics and text: a low proportion for production processes and procedures, utilization, and cost and administrative action. l. Graphics, text, and oral: a high proportion for utilization. m. Graphics, text, oral, and recall: a high proportion for test processes and procedures. n. Formal briefing: a high proportion for technical status, utilization, and cost and administrative action.
Q26 vs Q29	Actual Layout of Information Media vs. Field of Information	382.00	128	$\alpha < .0005$	.007	There is no pattern. Features of interest: a. Production, management and social sciences: a high proportion for telephone conversation, and group discussion. b. Medical sciences: a high proportion for photographs and text: and graphics, text, oral and recall. c. Aeronautics and space technology: a high proportion for graphics. d. Chemical sciences: a high proportion for narrative text, and tables or lists. e. Research and research equipment: a high proportion for graphics, text, oral, and recall. f. Mathematics: recall.
Q27 vs Q5	Desired Layout of	265.38	96	$\alpha < .0005$	.016	There is no apparent pattern. Features of interest: a. Hardware: a high proportion for telephone conversation, photographs and text, slides and motion picture, and formal briefings. b. Technical data: narrative text, and tables or lists. c. Design: no outstanding features. d. Finding: narrative text, and tables or lists; graphics, text, oral and recall. e. Recommendations photographs and text. f. Decision: telephone conversation, group discussions, graphics and lists. g. Plan: no outstanding features.

Table A-14-2. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q27 vs Q9	Desired Layout of Information Media vs. Kind of Task	471.32	176	$\alpha<.0005$	-.057	There is no apparent pattern. Features of interest: a. Basic research: a high proportion for recall, and graphics, text, oral, and recall. b. System analysis: a high proportion for graphics, text and oral. c. Production processes: a high proportion for graphics; text, oral and recall; and formal briefings. d. Production end-items: graphics, photos and text, and informal briefings. e. Reliability and quality control: a high proportion for tables or lists; and narrative text and tables or lists. f. Customer relations: tables or lists.
Q27 vs Q10	Desired Layout of Information Media vs. Field of Task	337.33	128	$\alpha<.0005$	.016	There is no apparent pattern. Features of interest: a. Production, management and social sciences: a high proportion for group discussion. b. Medical sciences: a high proportion for narrative text; narrative text and tables or lists; photos and text; graphics, text, oral and recall; graphics text and oral; and formal briefings. c. Mechanical, industrial, civil, and marine engineering: a high proportion for graphics, tables or lists; and narrative text and tables or lists. d. Aeronautics and space technology: a high proportion for graphics. e. Chemical sciences: a high proportion for photographs and text; and graphics, text, oral and recall. f. Research and research equipment: a high proportion for informal briefing. g. Mathematics: a high proportion for narrative text; and graphics, text, oral and recall.
Q28 vs Q3	Class of Information vs. Task Duration	168.95	96	$\alpha<.0005$	-.019	Feature of interest: a. Test process and procedures have proportionally shorter tasks.
Q28 vs Q5	Class of Information vs. Type of Task Output	398.38	72	$\alpha<.0005$	.059	There is no apparent pattern. Features of interest: a. Hardware: a high proportion for design or design techniques; and a low proportion for math aids and computer programs, and evaluation. b. Technical data: a high proportion for math aids and computer programs, and experimental processes and procedures. c. Design: a high proportion for design and design techniques; and a low proportion for math aids and computer programs, and cost and administrative action. d. Finding: a high proportion for experimental processes and procedures, and evaluation; and a low proportion for design. e. Recommendation: no outstanding features. f. Plan: a high proportion for cost and administrative action; and a low proportion for experimental processes and procedures.

Table A-14-2. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
Q28 vs Q9	Class of Information vs. Kind of Task	1310.25	132	$\alpha < .0005$	.114	High proportion features: a. Concepts: research. b. Design or design techniques: engineering and operational development. c. Experimental processes and procedures: research and production end-items. d. Text process and procedures: test or evaluation. e. Evaluation: system analysis and reliability and quality control. f. Specifications: reliability and quality control. g. Production: production processes and end-items, and reliability and quality control. h. Technical status: customer relations.
Q28 vs Q10	Class of Information vs. Field of Task	1028.13	96	$\alpha < .0005$	-.091	High proportion features: a. Concept: physical science. b. Math aids and computer programs: mathematics, research (including computer science). c. Experimental processes and procedures: medical sciences, and chemical science and materials. d. Production: production, management, and social sciences, and chemical science and materials. e. Technical status: medical sciences. f. Cost and administrative: production, management, and social sciences, and mechanical industrial, civil, and marine engineering.
Q28 vs Q29	Class of Information vs. Field of Information	2884.62	96	$\alpha < .0005$	-.206	As class of information moves from research to customer relations, there is a tendency for field of information to move from mathematics to production. Features of interest: a. Production, management, and social sciences: a high proportion of production processes and procedures, utilization, and cost and administrative action; and a low proportion of math aids and computer programs, and experimental processes and procedures. b. Medical sciences: a high proportion of raw data, experimental processes and procedures, and technical status. c. Aeronautics and space technology: a high proportion of design or design techniques; and a low proportion of math aids and computer programs, experimental processes and procedures, and production processes and procedures. d. Electronics and electrical engineering: a low proportion of math aids and computer programs. e. Chemical sciences and materials: a high proportion of raw data, experimental processes and procedures, and production processes and procedures. f. Physical science: a high proportion of concepts; and a low proportion of production processes and procedures, cost and administrative action, and utilization.

Table A-14-2. (Cont)

Questions	Description	χ^2	df	α	r	Remarks
QV28 vs QV29 (Cont)						g. Research (including computer science): a high proportion of math aids and computer programs, and experimental processes and procedures; and a low proportion of concepts, raw data, and evaluation. h. Mathematics: a high proportion of math aids and computer programs, and concepts; none for test processes and procedures, production processes and procedures, utilization, and cost and administrative actions.
Q28 vs Q30	Class of Information vs. Essentiality of Information	134.00	36	$\alpha < .0005$	.006	There is no pattern. Features of interest: a. Somewhat helpful: a high proportion for technical status, utilization, and cost and administrative action. b. Extremely helpful: a high proportion for math aids and computer programs, technical status, and utilization. c. Absolutely essential: no outstanding characteristics. d. Neither essential nor helpful: none for concept evaluation, technical status, and cost and administrative action.
Q28 vs Q31	Class of Information vs. Extensiveness of Information Use	202.45	60	$\alpha < .0005$	-.019*	There is no pattern. Features of interest: a. Not used at all: a high proportion for experimental processes and procedures, and cost and administrative action. b. As a lead to other information: a high proportion for concept, experimental processes and procedures, and utilization. c. As background information: a high proportion for concepts. d. In a small portion of task: a high proportion for cost and administrative action. e. In a major portion of task: no outstanding features. f. Throughout task: no outstanding features.
Q29 vs Q30	Field of Information vs. Essentiality of Information	83.24	24	$\alpha < .0005$	.011	There is no pattern. Only feature of interest is the high proportion of "somewhat helpful" for mathematics.
Q29 vs Q31	Field of Information vs. Extensiveness of Information Use	115.73	40	$\alpha < .0005$	-.026*	There is no pattern. Only outstanding feature is that chemical sciences and materials are high for "not used at all" and "as a lead to other information."
Q30 vs Q31	Essentiality of Information vs. Extensiveness of Information Use	2293.95	15	$\alpha < .0005$	.462*	The more essential the information, the more extensive its use in the task.

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*Data taken from two-way tables rather than from correlation matrix.

APPENDIX 15. COMPUTER OPERATIONS

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APPENDIX 15. COMPUTER OPERATIONS

I. INTRODUCTION

To edit, compile and analyze the data developed during the survey, NAA prepared or modified a number of computer programs. These programs and their operating parameters are documented in this section.

A. Computer Programs Summary

Six basic programs are used against two basic sets of data.

1. The two basic sets of data are:

   a. Basic 1500. The data with one answer per question for each of the 1500 interviews.

   b. Expanded 5359. The data with one answer per question for each of the information units ("chunks") associated with an interview. There are 1500 interviews, containing 5359 information units.

2. The six basic programs are:

   North American Aviation Data Preparation Programs

   a. Edit, Creation and Updating - NAA01[1]. This program edits all data inputs and creates a new data tape, or updates the existing data tapes. The answer to each question is tested for proper code limits and, in some cases, is cross-checked with answers to other questions.

   b. Reorder - NAA02. This program reassigns the sequence of the coded responses to the interview questions. At the same time it packs the data records so more efficient computer runs may be made when using the two-way distribution analyses program. The 1500 records must provide for five chunks per chunk question and the 5359 records has only one chunk per question, so in actuality the two reorder programs are different.

   c. Rescale - NAA03. This program assigns scale values to the coded responses of the interview guides as an aid to gaining linearity which is necessary in the regression runs. From this program, the output data are expressed in binary form which is very efficient for all subsequent programs. Again, there is a separate program for the 1500 records and the 5359 records.

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[1] Each NAA program has a (b) version and a (c) version. The (b) versions are used with the Basic 1500 set of data, and the (c) versions are used with the Expanded 5359 set of data.

Biomedical Data Analysis Programs (see Reference 5)

d. Transgeneration - BMD095. This program accepts the data created by the reorder or rescale program and combines questions as desired for the regression analysis. This program was used to combine the questions as specified in "General Structure of Interview Profiles, Summarizing Indices and Structural Relationships."

e. Cross Tabulation with Variable Stacking - BMD08D. This program computes (a) two-way frequency distributions; (b) the chi-square values and degrees of freedom for each table; and (c) the means, standard deviations, and correlation coefficients for each pair of questions.

f. Stepwise Regressions - BMD02R. This program computes (a) a sequence of multiple linear regression equations in a stepwise manner: (b) a correlation matrix: a multiple regression coefficient; and (c) the standard error of estimate.

B. General Flow

To begin the Data Processing phase of this project, all Interview Guide responses were coded onto data processing coding sheets, checked, and subsequently keypunched and verified. The card description is presented in Table A15-1. The data cards were then sequenced by Interview Identification Number (I ID) and within I ID by Card Code. An initial tape file was created with a flow of new cases continually edited and added until the file reached 1500 cases or 6000 records. Each case on the tape file was subjected to both general and specific edits. checking for accuracy and consistency within each case and with its relation to the other cases in the file. A second data tape (the 5359 basic tape), an expanded version of the initial 1500 cases, was also created to allow analysis of all information chunks per question simultaneously.

Both basic data tapes were re-ordered (see formats, Figures A15-7, A15-8) and subjected to analysis by the BMD08D, Cross-Tabulation with Variable Stacking Program, creating two-way tables and one-way frequency distributions. The basic tapes were also rescaled and put through a variable Transgeneration program, BMD09S, for final analysis by the Stepwise Regression Program, BMD02R. The data flow is depicted in Figure A15-1.

C. Approach to Computer Documentation

For each program written, the documentation includes a description of the program, a definition of the Input/Output, and the computer operating instructions. Program listings as well as source and object program decks for all programs have been submitted to DOD.

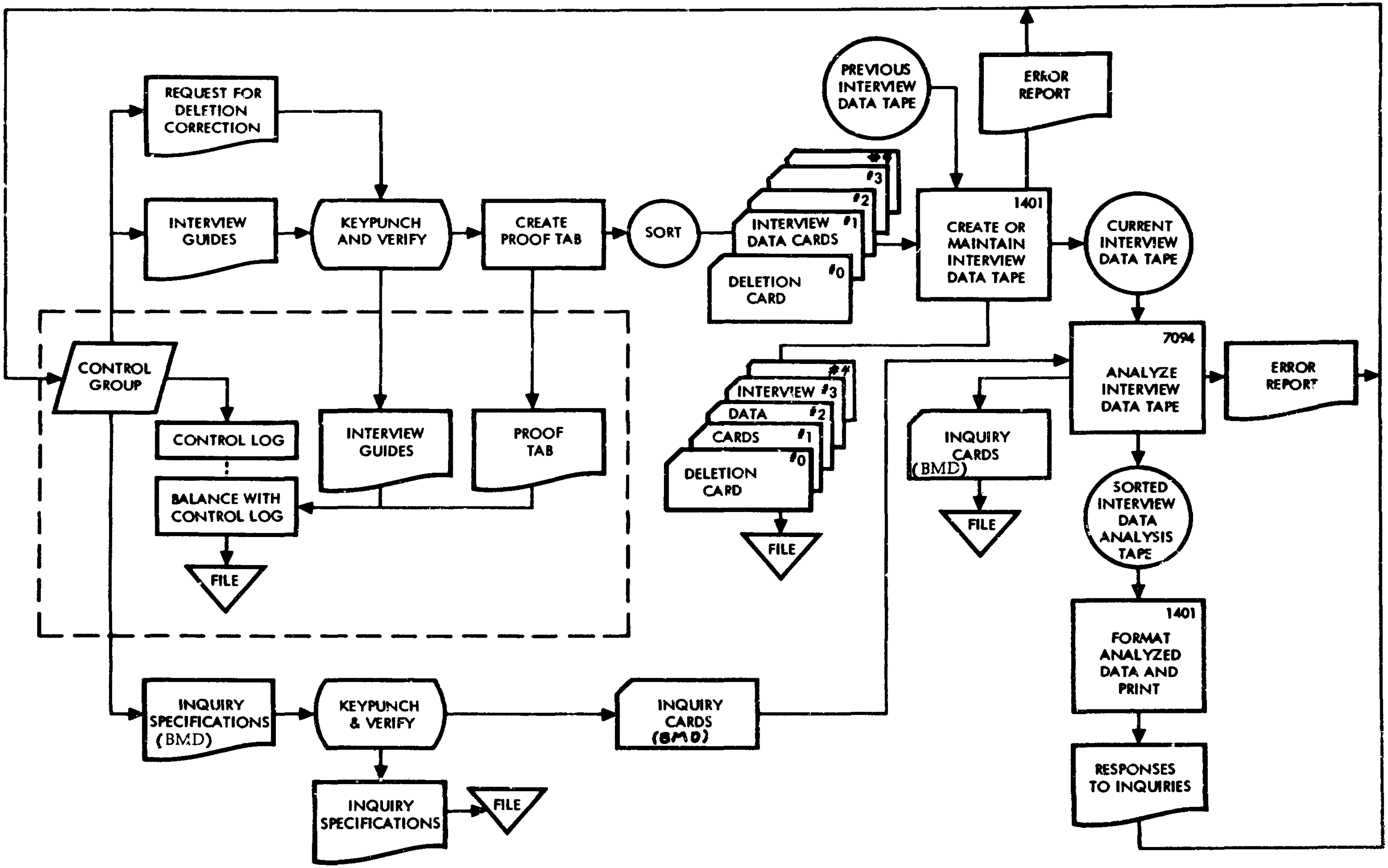


Figure A15-1. Computer Flow Chart

D. Operating Constraints

1. Machines

All Phase II programs are operational on the IBM 7094. Core is 32,000 positions with 4000 positions set aside for systems maintenance programs. The programs have been specifically adapted to the IBM 7094 Direct Couple System (DCS) which consists of an IBM 7040 connected to the 7094.

2. Times

The operating times specified for the programs discussed herein include execution time only. All read and write time is additional.

3. Languages

The Input/Edit programs (NAA01) are written in COBOL for the 7094; however, they are also available in 7010 COBOL. The Reorder (NAA02) and Rescale (NAA03) programs are written in FORTRAN IV, as are BMD09S and BMD02R. The BMD08D program is in FORTRAN II.

4. Tapes

Tape outputs from the Input/Edit programs and the Re-order programs are written in Binary Coded Decimal. Tape outputs from the Rescale and Transgeneration programs are written in Binary.

II. NAA COMPUTER PROGRAMS

A. Edit, Creation and Update (NAA01)

1. General Description

a. The computer Input/Edit programs serve three prime functions:

(1) To generate basic data tapes from the interview data cards

(2) To edit the accuracy and order of the raw data inputs

(3) To update the existing data files after the initial tape creation.

b. Options with this program include:

(1) Initial file creation

(2) File update

(3) Printout of the new tape

(4) Input/Edit Version I, 1500-Case Tape (AA01B)

(5) Input/Edit Version II, (5500-Case Tape (NAA01C)

Both card edit and tape creation are executed in one computer run. Program flow diagrams are shown in Figures A15-2, A15-3 and A15-4.

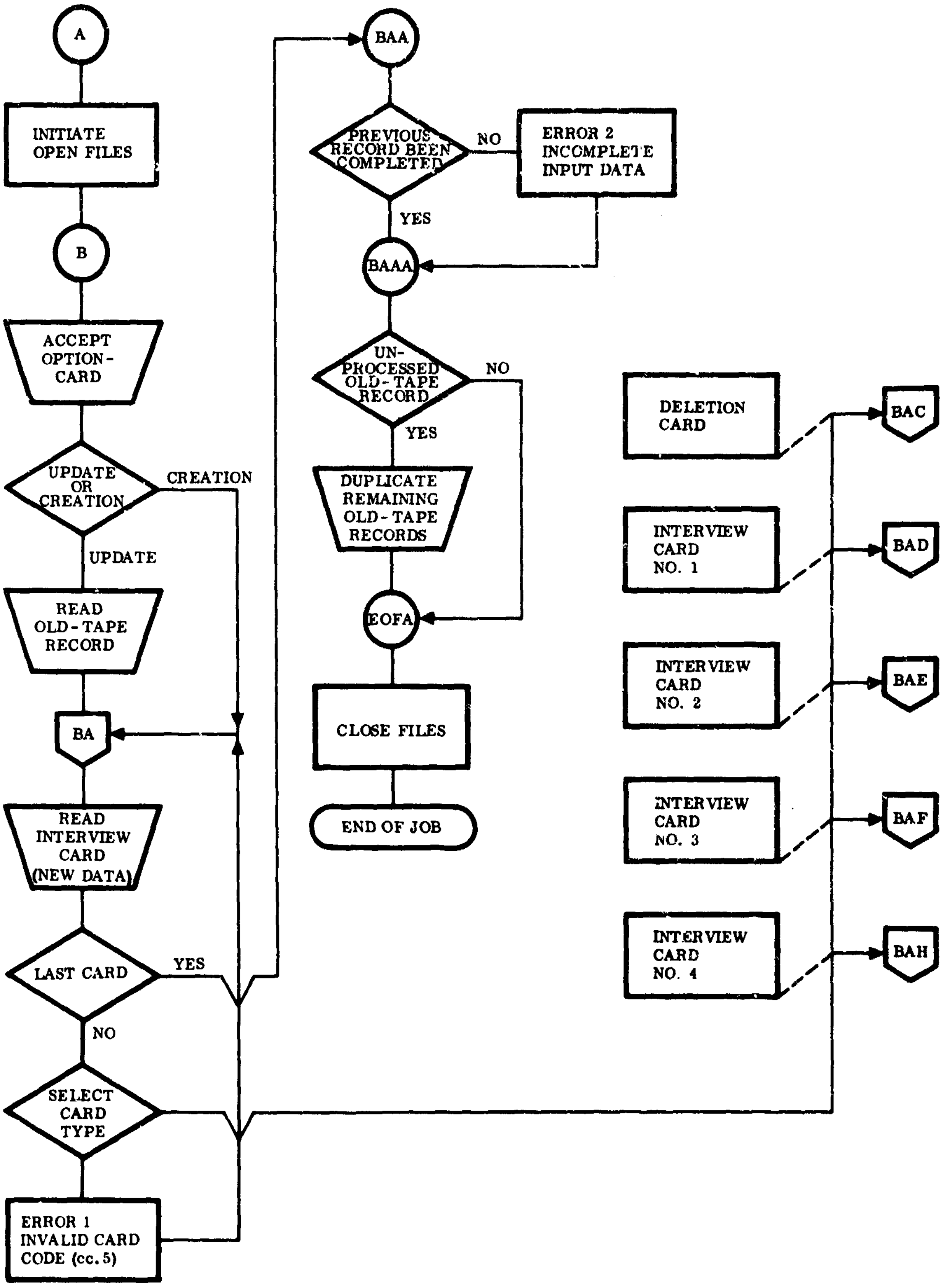


Figure A15-2. Program Flow for the Edit, Creation, and Update Program

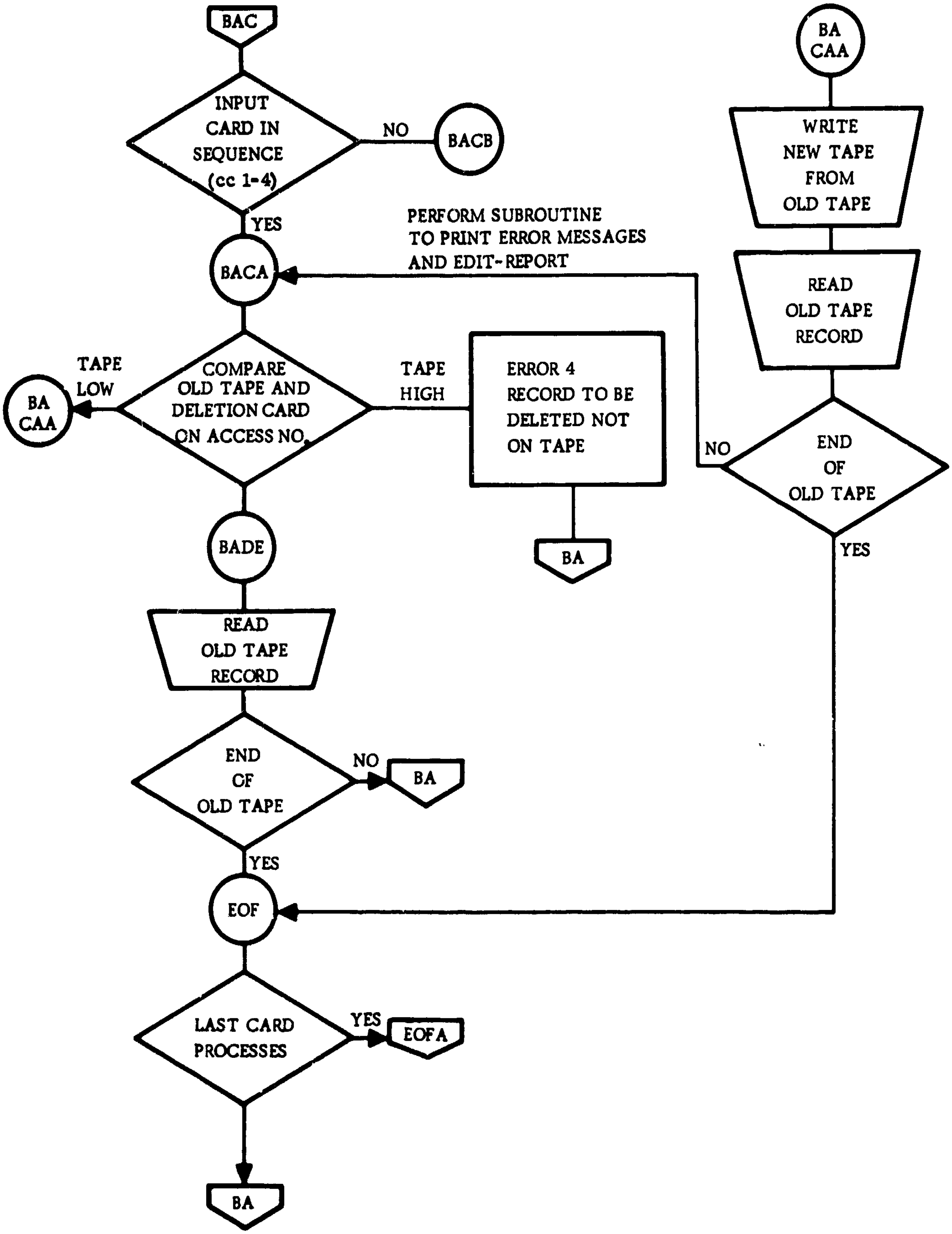
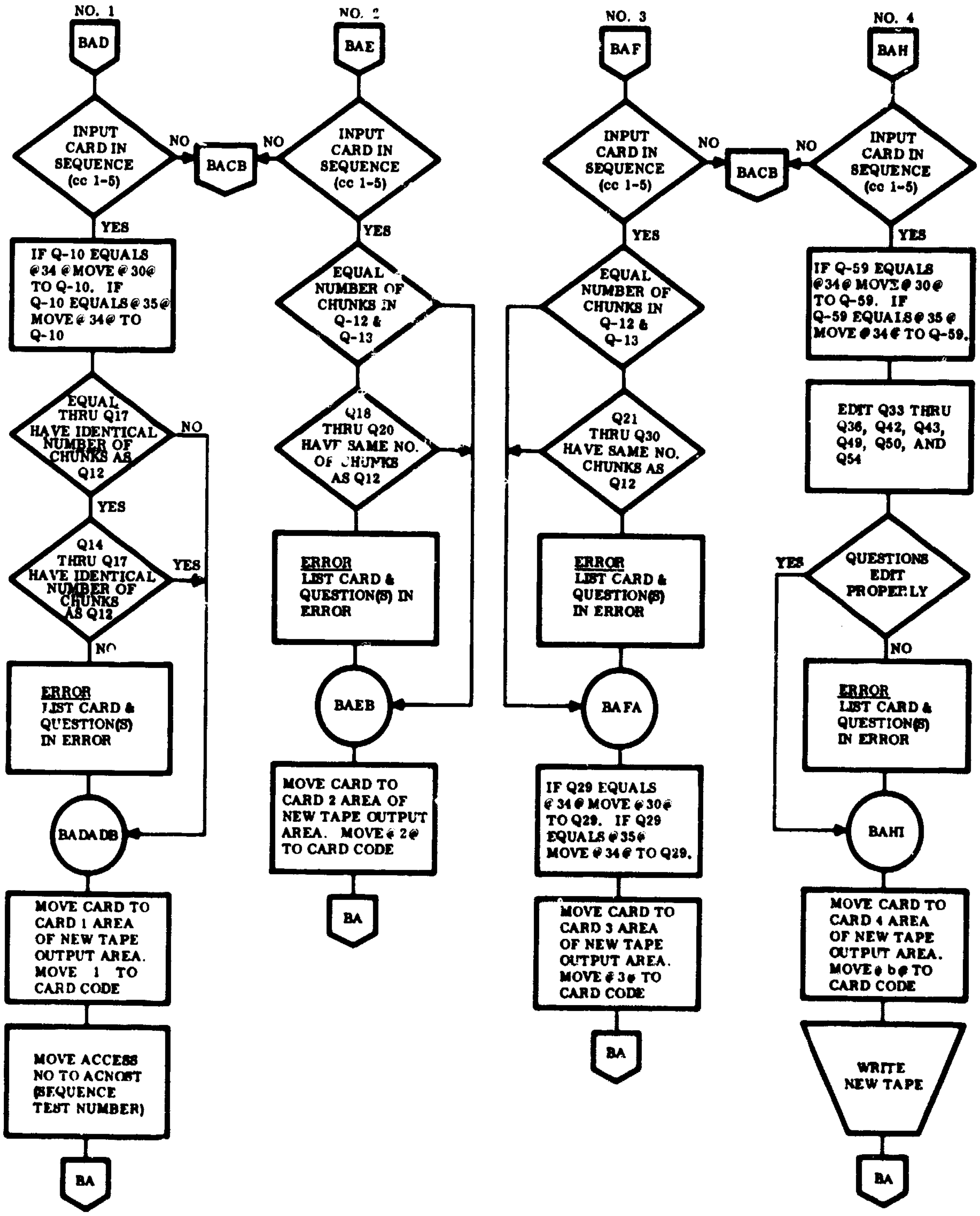


Figure A15-3. Flow of Maintenance Routine



FLOW OF EDIT ERROR ROUTINE

Figure A15-4. Flow of Edit Error Routine

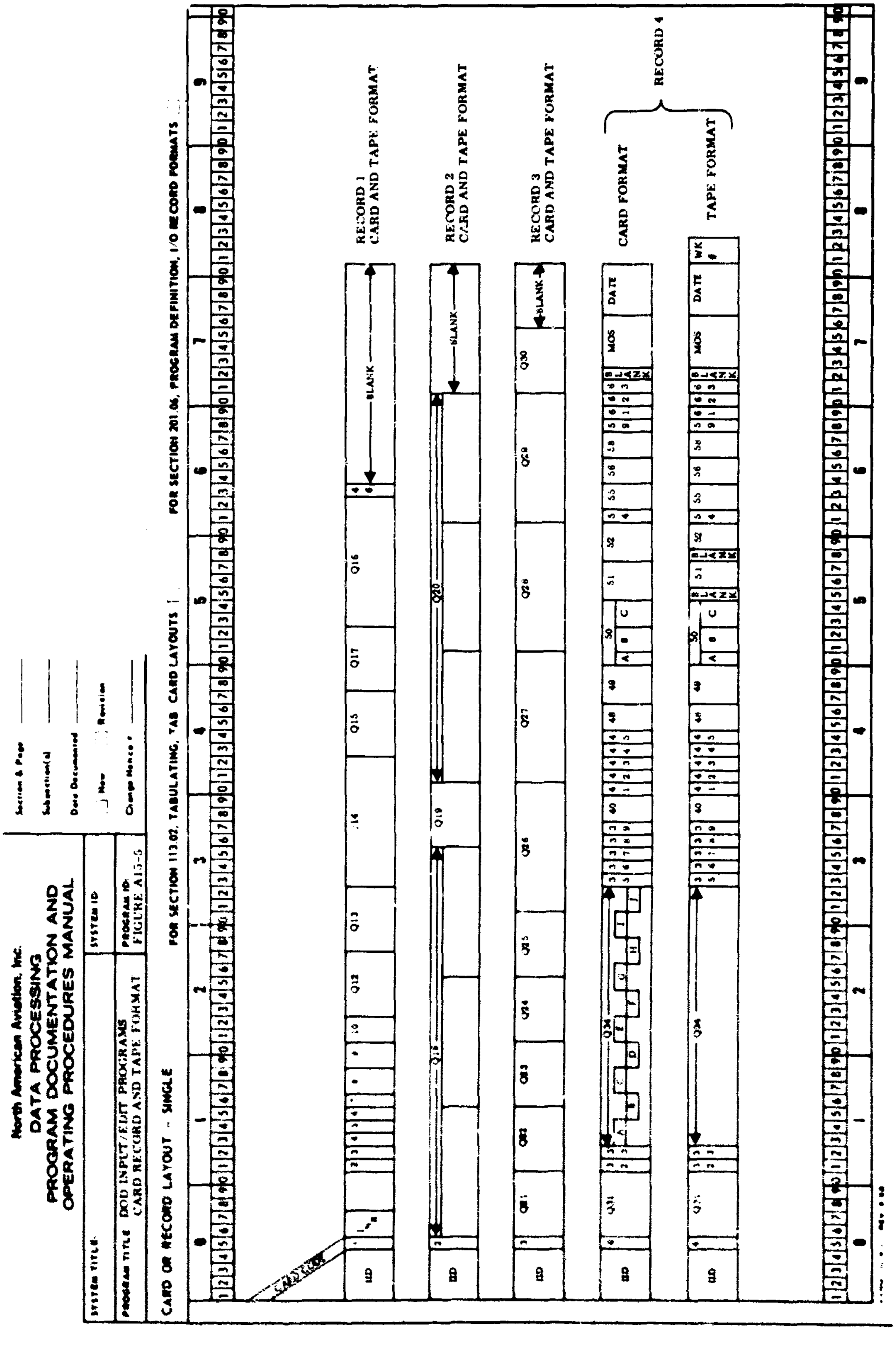
2. Version I - 1500 Case Input/Edit Program (NAA01B)

a. Input/Processing

The 1500 set of interview cases are input for initial file creation. The program creates a data tape and edits the data as it transfers the information from the data cards onto tape. See data card description in Table A15-1

b. Output (NAA01B)

Output for this program includes a 1500-case interview tape of 6000 records plus a tape printout if desired. The resulting records on the output tape are basically card images of the interview data as originally recorded on the data cards. See Figure A15-5. The only exceptions in case record No. 4 in which Questions 51 and 52 fields are reduced from 3 digits to 2 digits and in which the date field, columns 77-80 is converted into a specific week number in columns 81-82. This week number represents "weeks since start of interviewing."



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PROGRAM DOCUMENTATION AND
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Section & Page ___
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Date Documented ___
☐ New ☐ Revision
Change Notice # ___

SYSTEM TITLE:
SYSTEM ID:
PROGRAM TITLE: DOD INPUT/EDIT PROGRAMS CARD RECORD AND TAPE FORMAT
PROGRAM ID: FIGURE A15-5

CARD OR RECORD LAYOUT - SINGLE
FOR SECTION 113.02, TABULATING, TAB CARD LAYOUTS ☐
FOR SECTION 201.06, PROGRAM DEFINITION, I/O RECORD FORMATS

Figure A15-5. DOD Input/Edit Programs Card Record and Tape Format

Table A15-1. Card and Tape Format Description and Field Limitations

Question Number	Description	Card Column Numbers	Number of Digits
	INTERVIEW DATA CARD NO. 1		
I ID	Interview Identification No.	1-4	4
---	Card Number	5	1
---	INR (Interviewer No.)	6-7	2
---	Interview time	8-10	3
2	How task originated	11	1
3	Length of task	12	1
4	Percent of time devoted to task	13	1
5	Task output-type	14	1
6	Task output-form	15	1
7	Task output directed to	16	1
8	Task output-nature	17-18	2
9	Kind of task (R&D)	19-20	2
10	Field of task	21-22	2
12	Retrieval time-actual	23-27	5(1)
13	Retrieval time desired	28-32	5(1)
14	First source	33-42	5(2)
15	Reason first source used	43-47	5(1)
17	First source information received	48-52	5(1)
16	First source information desired	53-62	5(2)
46	Difficulties in information acquisition	63	1

Table A15-1. (Continued)

Question Number	Description	Card Column Numbers	Number of Digits
	INTERVIEW DATA CARD NO. 2		
	I ID	1-4	
	Card Number	5	
18	Media for chunk	6-35	5(6)
19	Habitual media? (if no, what is media?)	36-40	5(1)
20	Prefer chunk in another media?	41-70	5(6)
	INTERVIEW DATA CARD NO. 3		
	I ID	1-4	
	Card Number	5	
21	Exposure to info. - actual	6-10	5(1)
22	Exposure to info. - desired	11-15	5(1)
23	Search aids useful?	16-20	5(1)
24	Depth of info. obtained	21-25	5(1)
25	Depth of info. desired	26-30	5(1)
26	Physical arrangement of data - actual	31-40	5(2)
27	Physical arrangement of data - desired	41-50	5(2)
28	Class of chunk	51-60	5(2)
29	Habitual media?	61-70	5(2)
30	Need for info. chunk	71-75	5(1)
	INTERVIEW DATA CARD NO. 4		
	I ID	1-4	
	Card Number	5	
31	Use of info. card	6-10	5(1)

Table A15-1. (Continued)

Question Number	Description	Card Column Numbers	Number of Digits
	INTERVIEW DATA CARD NO. 4 (Cont)		
32	Did you find post-task information?	11	1
33	Does your company have a Technical Info. Center?	12	1
34	What services does your TIC have?	13-32	20
35	How often do you use TIC?	33	1
36	How is TIC categorized for need satisfaction?	34	1
37	How often observe TAB?	35	1
38	How often observe STAR?	36	1
39	Do you use DDC?	37	1
40	Which DOD data centers used most often?	38-39	2
41	Use other specialized data centers?	40	1
42	Any special restrictions encountered?	41	1
43	What was the nature of restriction?	42	1
44	Use foreign language translations?	43	1
45	Any trouble getting information?	44	2
48	Last 2 digits of year of birth	45-46	2
49	No. of technical people supervised	47-49	3
50-a	Highest degree	50	1
50-b	Year attained	51-52	2
50-c	Field of degree	53-54	2
51	Length of time doing this kind of work. Converted to (less than) years.	55-57	3
	TAPE COLUMNS ONLY	(56-57)	(2)

Table A15-1. (Continued)

Question Number	Description	Card Column Numbers	Number of Digits
	INTERVIEW DATA CARD NO. 4 (Cont)		
52	How long with company? Converted to (less than) years.	58-60	3
	TAPE COLUMNS ONLY	(59-60)	(2)
54	Type of activity (admin?)	61	1
55	Kind of activity (R&D)	62-63	2
56	Field of activity	64-65	2
58	Military or GS rating	66-67	2
59	Interviewer's opinion on respondent's need for scientific and technical information.	68	1
61	Procedure for use of information	69	1
62	Procedure for obtaining information	70	1
63	Output of task	71	1
	Blank	72	1
	MOS (Military Occupation Specification)	73-76	4
	Date	77-80	4
	Week (TAPE ONLY)	(81-82)	(2)

c. Order of Cards in Job Deck for Input/Edit Programs

(1) Systems Control Cards

(2) 7094 COBOL source or object program (NAA01B - NAA01C)

(3) Systems Data Control Cards

(4) Option Card (Creation or Update)

Column 1 - "1" Create

- "0" Update

Column 2 - "1" Tape printout desired

- "0" Tape printout not desired

(5) Interview Data Input Deck

(6) End of File Record (EOF)

See Figure A15-6 depicting order of cards.

d. Interview Data Card and Tape Description

The data from each interview placed on four data cards is referred to as a case. All responses are arranged in numerical sequence with the exception of Questions 17, 16, and 46 which are placed on Card No. 1. See Table A15-1. The tape record is a card image with the exception of Questions 51 and 52 and the "weeks since start of interviewing" in record form.

e. Sequence of 1500 Tape File

The tape file is ordered in sequence by the numeric I ID number and within I ID by card number.

3. Version II - 5359 Case Input Edit Program (NAA01C)

a. Input/Processing

The 5359 set of interview data cases is input for initial file creation. The program generates a tape file and edits the data as it transfers the information onto tape.

b. Output (NAA01C)

Output for this program is an expanded version of the 1500-case tape. Each interview chunk is considered as a separate case to allow inquiries which analyze all chunks simultaneously. Thus, what originally was a four-chunk interview on the 1500-interview tape expands to four separate cases. The 1500-interview tape (6000 records) expands to 5359 cases (21,436 records).

c. Sequence of 5359 Tape File

The maximum number of information chunks recorded in an interview guide is five. Since the 5359 chunk interviews are replicated into separate cases for each chunk, a code system is necessary to identify chunk number within I ID. In order to separately identify the chunk within I ID in the card and tape records, the first chunk case retains the original I ID number, the second and third chunk cases are identified with a 12(+) and an 11(-) punch over the units position of the I ID number respectively, and the fourth and fifth chunk cases are identified with 12 and 11 punch over the tens position of the I ID number respectively.

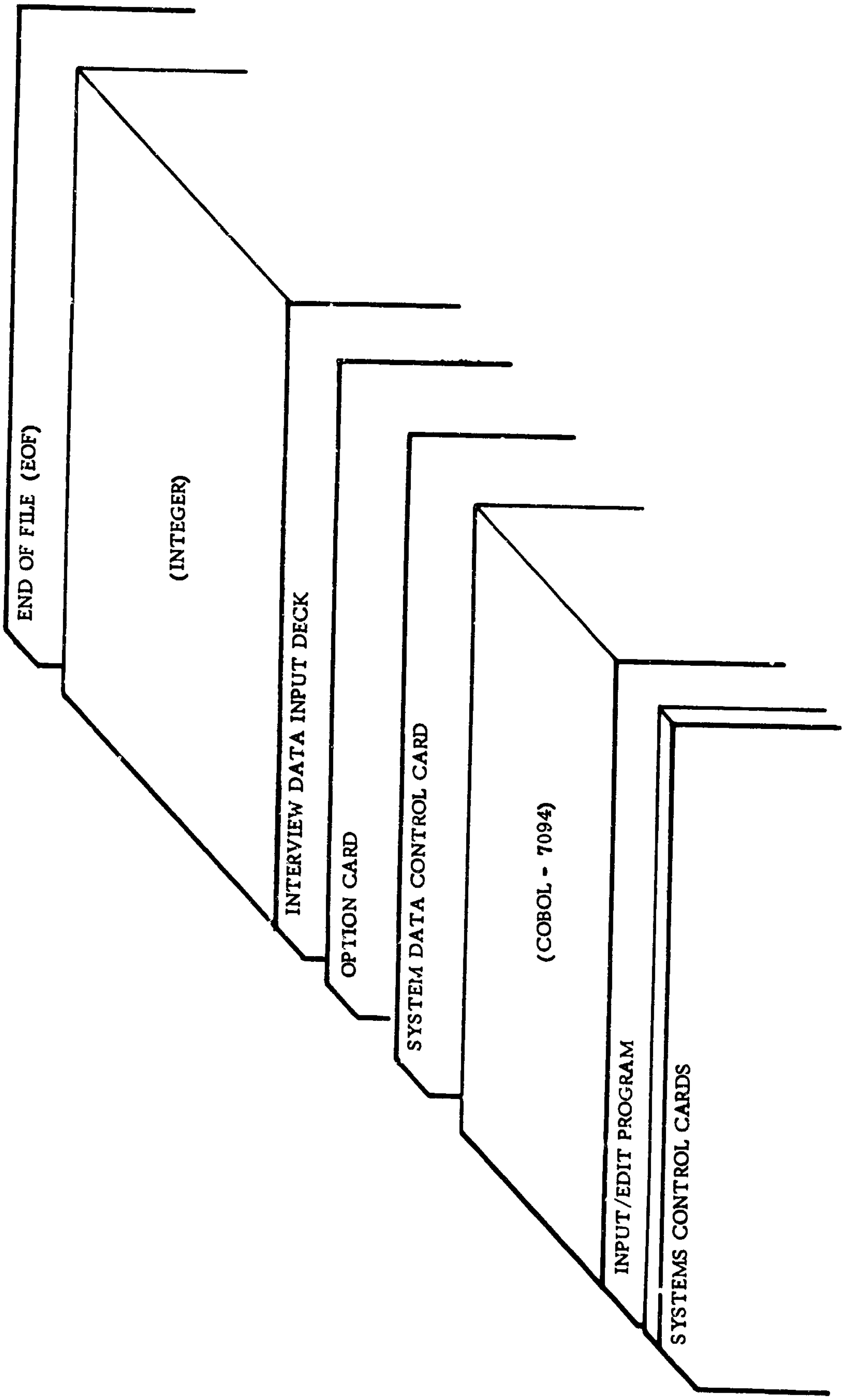


Figure A15-6. Order of Cards in Job Deck for Input/Edit Programs

When sorting the resultant 5359 records, the third and fourth digits (units and tens position) are sorted alphanumerically and the sequence of these two columns is 12-0, A through I, 11-0, J through R, and numeric last.

d. Interview Tape Description (5359)

The tape record layout is the same as that for the 1500 with the exception of the chunk question responses. Since only one chunk is recorded per I ID record, only the position provided for the first chunk is used.

4. File Update Runs (NAA01B - NAA01C)

a. Input/Output

The existing data tape plus necessary data card additions, deletions or changes are input to this program. Program output is a new updated data tape, plus an edit-error report if bad data is entered. Only those cases being added or changed are subjected to the edit routine.

b. Deletions

Deletion of a case from the tape file is accomplished as follows:

(1) Place deletion card directly in front of case to be deleted.

(2) Deletion Card:

Columns	Description
1-4	I ID
5	"0"

c. Additions

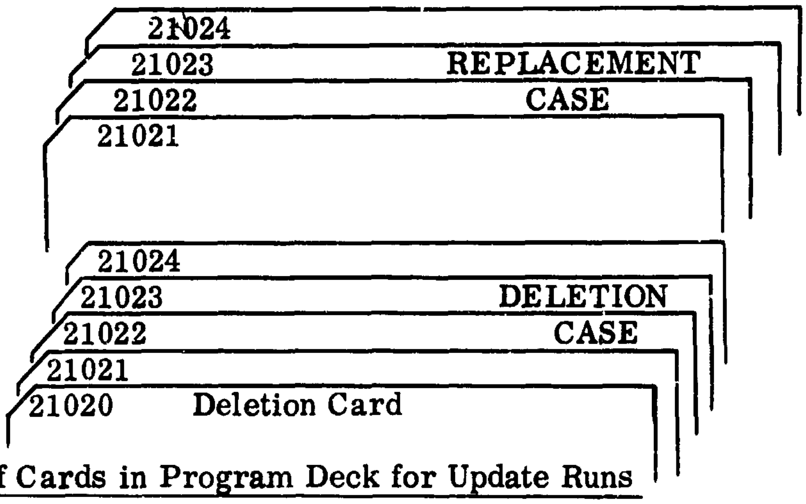
All additions and deletions must be in the same I ID sequence as that of the file to be updated. Both additions and deletions can occur within one run. WARNING: If a deletion card precedes the addition of a record and there is no old record to delete, the new record will not enter.

d. Data Changes to Tape File

(1) Delete interview case to be changed.

(2) Input the entire corrected case of four cards behind the deletion case.

(3) Card Order



e. Order of Cards in Program Deck for Update Runs

(1) Systems control cards to mount existing data tape file.

(2) Systems control cards to save new data tape file.

(3) 7094 COBOL Edit Source or Object Program (NAA01B - NAA01C).

(4) Systems Data Control Cards

(5) Option Card:

Column 1 - "0" Update
Column 2 - "1" Tape printout desired
- "0" Tape printout not desired

(6) Additions, deletions and changes to data tape file. All input cards to the new tape must be in order by I ID and card code.

5. Programmed Error Instructions

The Input/Edit Program has two types of editing features: general edits and specific edits. General editing of each card is performed in relation to other cards in the interview deck. Specific edits are performed on questions within each interview.

a. General Edits

(1) Error 1 (ER01)

- Condition: Card code (column 5) is something other than 0, 1, 2, 3, or 4.
- Printout on Error Report: ER01 - Card code is something other than 0, 1, 2, 3, 4, or 5.

- Programmed Action: All cards having the same interview accession number as the erroneous card are not put on the output magnetic tape. The cards which have the same interview accession number and which also have a sequentially lower card code will appear as out-of-sequence, Error 3.

- Corrective Action: Correct the card with the erroneous card code and enter the corrected card with all other cards having the same interview accession number in a subsequent run.

(2) Error 2 (ER02)

- Condition: Less than four input cards for any one case.

- Printout on Error Report: ER02 will appear with the card image of the interview card that does not belong to a full case or set of four cards.

- Programmed Action: Case omitted from output tape.

- Corrective Action: In a subsequent run, enter all four input cards for the interview for which data were not processed.

(3) Error 3 (ER03)

- Condition: Input cards entering the system are not in ascending sequence by interview accession number columns 1-4 or within interview accession number.

- Printout on Error Report: ER03 plus the card image of the card which is out of sequence.

- Programmed Action: Data from the out-of-sequence cards are not processed onto the output tape.

- Corrective Action: In a subsequent run, enter all four input cards for the interview whose data were not processed.

(4) Error 4 (ER04)

- Condition: Unable to find record to be deleted on old tape.

- Printout on Error Report: ER04 and contents of deletion card.

- Programmed Action: None. Program will not accept new record for same I ID if it follows this card.

- Corrective Action: Correct the interview accession number specified in the deletion card and enter the card in a subsequent run.

b. Specific Edits

(1) Question 10 - Field of Task

- Condition: If Q-10 contains a 30 or a 34.
- Printout on Error Report: None.
- Programmed Action: On Q-10, a 34 is replaced by 30, and a 35 is replaced by a 34 on the interview data tape.

(2) Questions 12 through 30 - Incorrect Number of Chunks

- Condition: Questions 12 and 13 have a different number of chunks or questions 14 through 30 have a different number of chunks from 12 and 13.
- Printout on Error Report: Accession number of interview in error, card number in error, image of card in error, and question in error.
- Programmed Action: The interview data are processed. The error is placed on the edit-error report with the preceding format.
- Corrective Action: The errors on cards are to be corrected. All four input cards of the same accession number preceded by a deletion card for the same are to be entered in a subsequent run.

(3) Question 29 - Habitual Media

- Condition: If Q-29 contains a 30 or a 34.
- Printout on Error Report: None.
- Programmed Action: In Q-29, a 34 is replaced by 30, and a 35 is replaced by a 34 on the interview data tape.

(4) Questions 33 through 36 - Technical Information Center

- Condition: If Q-33 contains a 2 or a 3, then Q-34, Q-35, and Q-36 should contain all zeroes.
- Printout on Error Report: Accession number of interview in error, card number in error, image of card in error, and "QST-33."

- Programmed Action: The record is accepted in the file. If this test is not met, a message is printed on the error report.

- Corrective Action: The case or cases in error must be corrected and submitted on a File Update run.

(5) Questions 42 and 43 - Special Restrictions

- Condition: If a "2" is marked in the box of question 42, question 43 must be blank.

- Printout on Error Report: Interview identification number in error, card number in error, image of card in error, and "Q-43" for question 43.

- Programmed Action: The record is accepted in the file. If this test is not met, a message is printed on the error report.

- Corrective Action: Enter corrected data on File Update run.

(6) Question 50 - Highest Education

- Condition: If the first box contains a 6, the four following positions must contain zeroes.

- Printout on Error Report: Interview identification number in error, card number in error, image of card in error, and "Q-50."

- Programmed Action: The record is accepted in the file. If this test is not met, a message is printed on the error report.

- Corrective Action: The cases in error must be corrected and submitted on a File Update run.

(7) Question 49 and 54 - Type of Activity (Administrative)

- Condition: If question 54 contains a 1, 2, or 3 signifying administrative activity, question 49 (number of technical people supervised) must be greater than zero.

- Printout on Error Report: Same as Q-43 except use "Q-49" to replace "Q-43."

- Programmed Action: The record is accepted in the file. If this test is not met, a message is printed on the error report.

- Corrective Action: The case or cases in error must be corrected and submitted on a File Update run.

*Re

(8) All Questions - Limits

- Condition: The question has a response that is outside the limits imposed by the interview guide or subsequently published code limits.
- Printout on Error Report: Interview identification number of card in error, card number in error, image of card in error, limits restriction exceeded, number of question outside specified limits.
- Programmed Action: The record is accepted in the file. If this test is not met, a message is printed on the error report.
- Corrective Action: The case or cases in error must be corrected and submitted on a File Update run.

6. Operating Instructions

a. Programs: (a) 1500 Case Input/Edit Program (NAA01B)
(b) 5359 Case Input/Edit Program (NAA01C)

b. Language: COBOL-7094. COBOL 7010 programs are available for both NAA01B and NAA01C.

c. Machine: IBM 7094. Direct Couple System (DCS)

d. Operating Time

* NAA01B Execution Time (Initial) 125 sec.
* NAA01B Execution Time (Update) (30 + 0.08c) seconds

* NAA01C Execution Time (Initial) 450 sec.
* NAA01C Execution Time (Update) (30 + 0.08c) seconds

c = number of interview codes being updated

e. Input (NAA01B) and (NAA01C)

(1) File Creation

- Option Card. The option card must be placed immediately behind the systems data card.

  Col. No. 1 "1" For file creation.
  Col. No. 2 "0" If no printout desired.
  Col. No. 2 "1" If no printout desired.

- Data (Sequenced)

---

ead time not included

(2) File Update

- Tape File to be changed.
- Option Card

  Col. No. 1 - "0" for update.
  Col. No. 2 - "0" if no printout desired.
  Col. No. 2 - "1" if printout desired.

- Additions, Deletions and Update Data.

f. Outputs - Data tapes with accompanying edit error reports.

B. Re-order (NAA02)

1. General Description

The re-order program was created specifically for the Phase II study to present the data for the two-way tables in a sequence compatible with the scaling for regression. Using the basic sets of data, the re-order program reassigns the sequence of the coded responses to the interview questions, placing them in a more desirable order for program analysis. Output from the program includes a re-ordered data tape with a code table printout showing the re-ordered response sequence and the old order of responses.

Different versions of the program are necessary to re-order the two basic sets of data. Version I is the 1500 Re-order program (NAA02B) and Version II is the 5359 Re-order program (NAA02C). Input operations are basically the same for both programs; however, the output tapes differ materially.

2. Version I - 1500 Re-order Program (NAA02B)

The 1500 Re-order program re-orders and compacts the original basic data tape created from the 1500 Input Edit program. As noted in the Input Edit Section IIA2, the basic data tape consists of 1500 cases comprising 5000 records. By compacting the information, the Re-order program reduces the number of record gaps and the number of records on the tape. Each case utilizes three records instead of the original four thus reducing the total tape record count to 4500. See Figure A15-7, 1500 Re-order Tape Layout. This reduction in the size of the tape record enables BMD08D to operate with less time consumption per problem.

3. Version II - 5359 Re-order Program (NAA02C)

The 5359 Re-order program re-orders and compacts the original 5359 basic data tape created from the 5359 Input Edit program. The compacting materially reduces the tape storage requirement of the data from 21,436 records on the original tape to 5359 records on the output re-ordered tape. Elongating the record size and eliminating

the chunk fields not utilized for data inputs to the BMD08D program are the contributing factors to the reduction of tape size, records, and record gaps. See Figure A15-8 for the 5359 Re-order Tape Layout.

4. Program Input Operations

Input (NAA02B - NAA02C)

a. Data Tape to be Re-ordered:

NAA01B - 1500 basic data tape
NAA01C - 5359 basic data tape

b. Program Setup Cards:

(1) Location Arrangement

The Re-order program utilizes a total of 495 machine memory locations: 1) to identify the number of cases to be re-ordered; 2) to identify the variable which are not to be re-ordered; and 3) to indicate the new values for those variables being recoded. The following is a general description of the memory location specification.

INPUT SPECIFICATIONS

Memory Identification Number(s)	Input Description
1	Number of cases on input tape.
2 through 64	"Variable" control fields.
65 through 495	"Variable" data fields for new response order values or codes.

For a more detailed specification of input, consult Table A15-2. The above information is entered on program setup cards which for the purpose of clarification are divided into two categories; the "variable" control cards and the "variable" recode data cards. Refer to paragraphs 4b(4) and (5).

(2) Program Setup Card Description

Each program setup card contains one memory identification or address field and five "variable" control or data fields of twelve columns each. All entries into the five "variable" control or data fields must be left justified and written with a decimal point; although, the original variable responses enter the program in the integer mode, and tape output responses are written in the integer mode. The following is a description of the program setup card layout.

PROGRAM SETUP CARD DESCRIPTION

Columns	Field Description
1-8	Blank except for last variable control card in which a "1" is placed in column one.
9-12	Memory Identification Number - Field address of first control or data field on setup card. Must be right justified.
13-24	First control or data record field - left justify.
25-36	Second control or data record field - left justify.

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Section & Page 101.
Subsection(s) .80
Date Documented
☐ New ☐ Revision
Change Notice #

SYSTEM TITLE: 1500 RE-ORDER TAPE LAYOUT
SYSTEM ID: FIGURE A15-7

101 .22 SYSTEM DEFINITION
101 .80 REPORTS LAYOUTS

CARRIAGE TAPE IS: STD. ☐ NON-STD. ☐

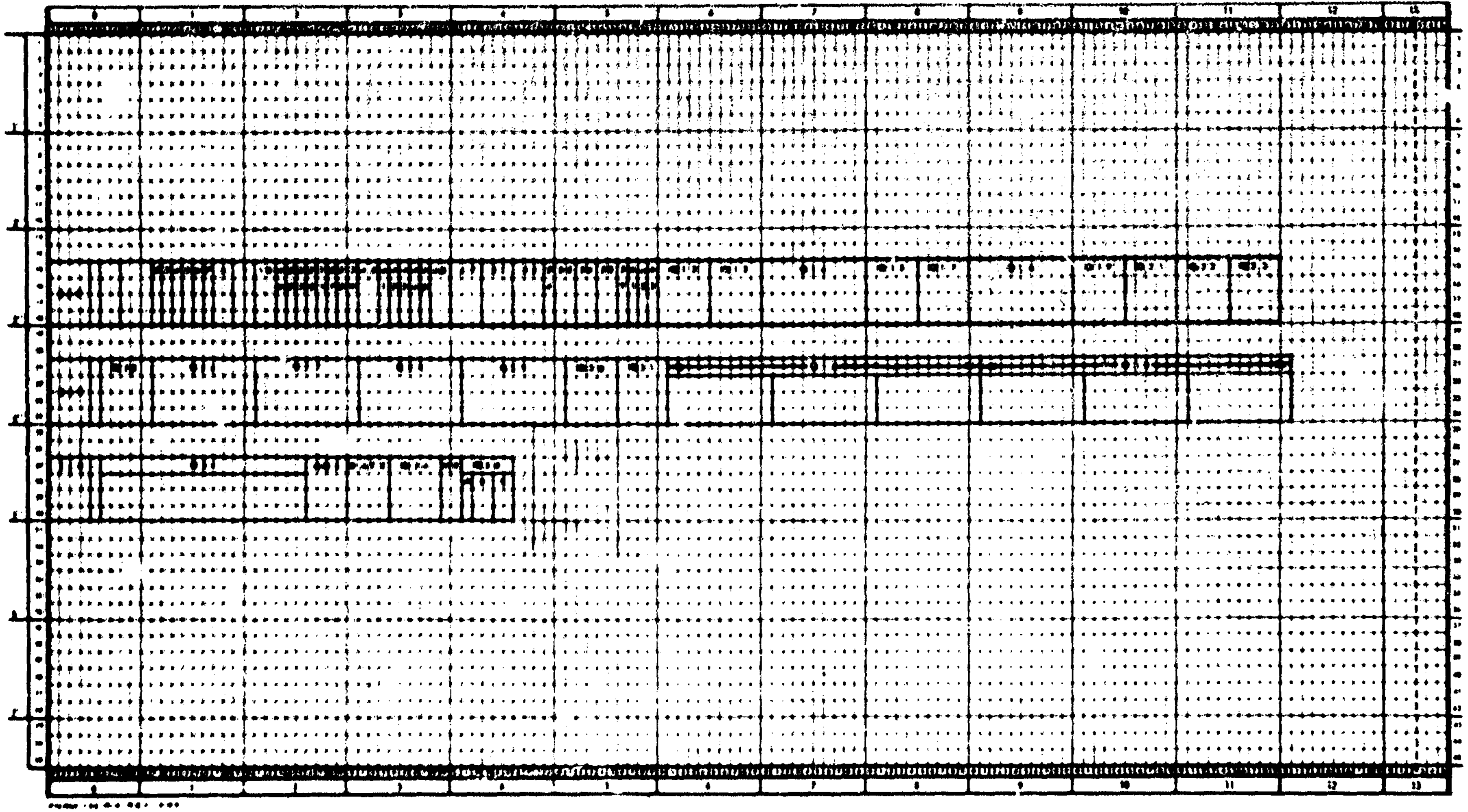

Figure A15-7. 1500 Re-Order Tape Layout

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OPERATING PROCEDURES MANUAL

SYSTEM TITLE: 5359 RE-ORDER TAPE LAYOUT	SYSTEM ID: FIGURE A15-8

Section & Page 101.
Subsection(s) .08
Date Documented
☐ New ☐ Revision
Change Notice #

101.XX SYSTEM DEFINITION
101.08 REPORTS LAYOUTS

CARRIAGE TAPE IS: STD. ☐ NON-STD. ☐

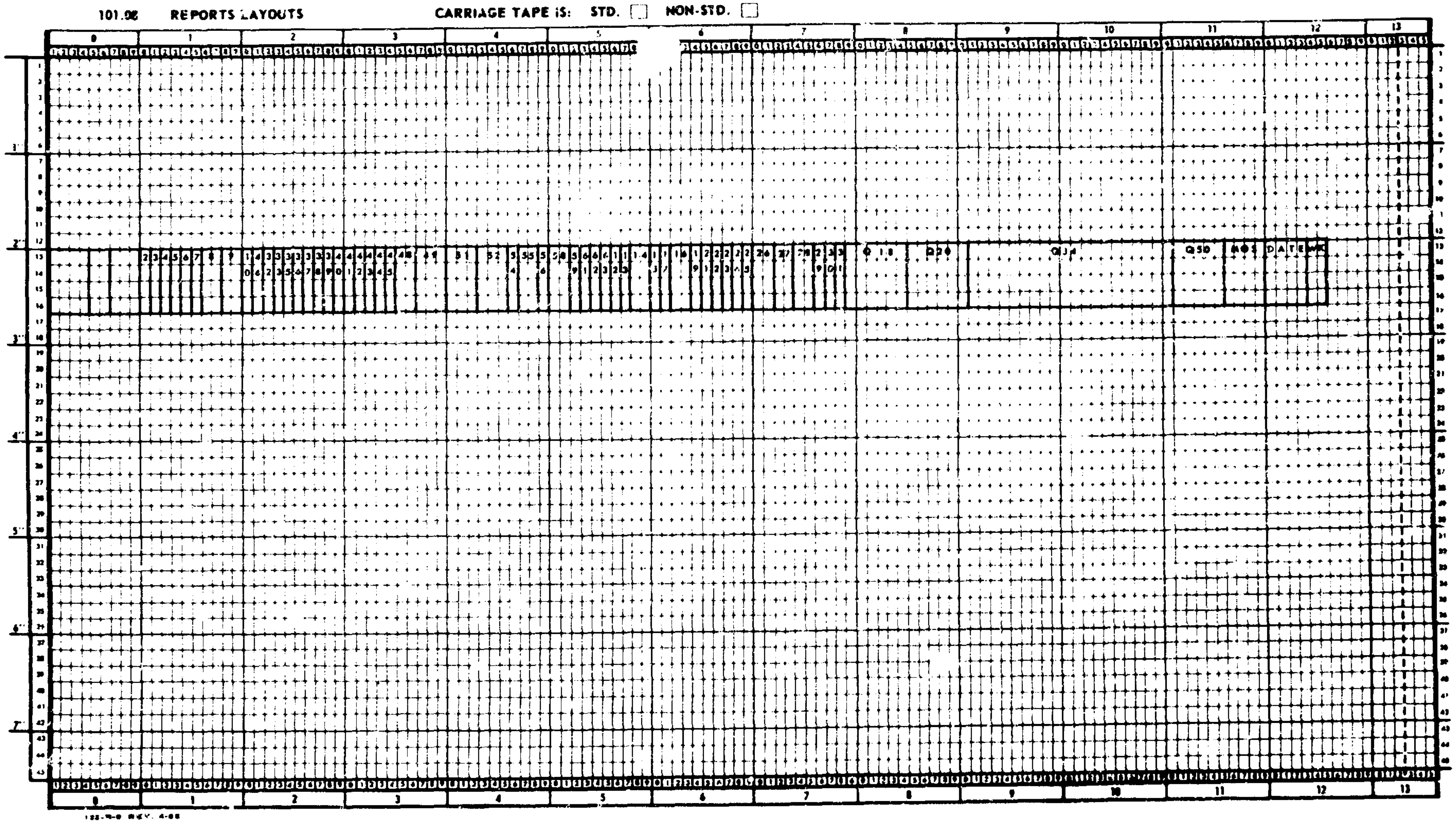


Figure A15-8. 5359 Re-Order Tape Layout

Columns	Field Description
37-48	Third control or data record field - left justify.
49-60	Fourth control or data record field - left justify.
61-72	Fifth control or data record field - left justify.
73-80	Columns reserved for card sequence control. (Optional)

(3) Program Setup Card Requirements

(1) The first setup card must contain the number of tape input cases in columns 13-24. The NAA basic input tapes have either 1500.0 or 5359.0 input cases.

(2) The last program setup card must have a "1" in column one to indicate that this card contains the last of the data inputs.

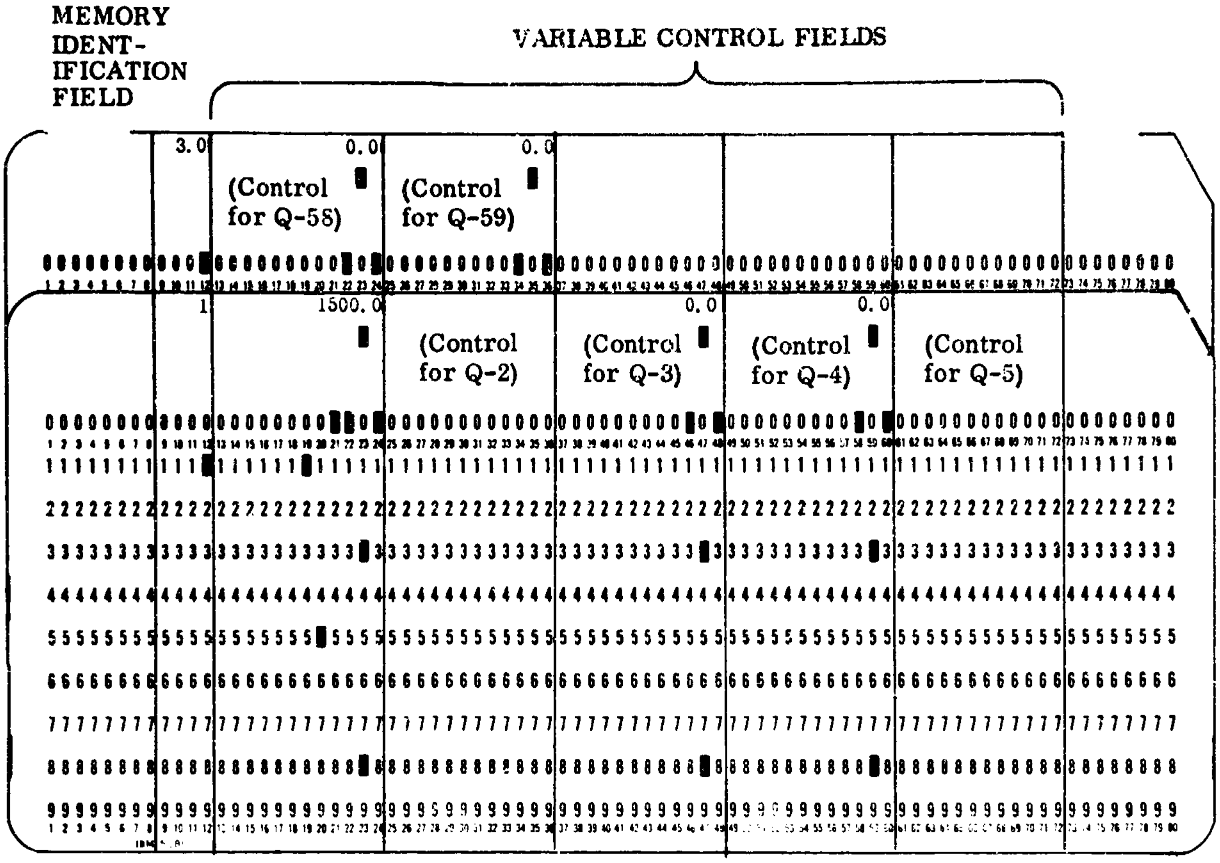
(4) "Variable" Control Cards

The variables which are not to be re-ordered must be so indicated in the "Variable" control cards. To accomplish this function, each variable is given a control field with an address ranging from 2 to 64 - one field address for each variable. Table A15-2 shows each variable with its accompanying control field address. The field addresses referred to are in fact the memory identification numbers. The field addresses may run sequentially through the control cards or at any point an address may be called out on a new card. To indicate that a variable must not be re-ordered, a 0.0 must be entered in the proper field of the control card housing the variable's control field address.

The following example is a hypothetical control input. As specified earlier, the first memory address No. 1 must specify the number of tape input cases. The entries following indicate to the program that the variables with control addresses 3, 4, 30, and 31 (for Q3, Q4, Q58, and Q59 respectively) should not be reordered. See Table A15-2 for the interview questions with these addresses. The program then assumes that all other variables will be re-ordered.

(5) "Variable" Recode Data Cards

The function of the recode data cards is to recode the original order of the interview questions. For this purpose, each variable is given a group of response data fields in which the re-order responses may be entered. Table A15-2 gives the first response field address for each variable and its maximum number of response fields. The sequence of the data fields assigned to each variable or question represent the original order of the responses for that question. To illustrate this point, Question No. 2 in Table A15-2 has a maximum response range of eight which means



it has eight responses in the Interview Guide. Each response corresponds to a data field; therefore, Question No. 2 has eight data fields in the program. Before any re-order data is entered into these fields, the program considers the fields to represent the original sequential order of the responses to Question No. 2 as reflected in the Interview Guide. Thus, to change the sequence order of a response, its original sequence field must be re-ordered with its new sequence order number.

QUESTION NO. 2

Original field sequence and applicable codes	1, 2, 3, 4, 5, 6, 7, 8
Data as entered to re-order original responses	6, 5, 4, 1, 2, 3, 0, 0

As the following example (card set) shows, response 1 of Question 2 is being re-ordered to a 6, response 2 is being re-ordered to a 5, etc. The example illustrates recoding of Question 2 responses, Question 5 responses, and the first two codes of Question 6. The maximum number of fields for any variable must not be exceeded; otherwise, the coded responses beyond the maximum will recode the next question's responses.

(6) Bad Data Points

If it is desired to eliminate any original responses from the re-ordered data tape as shown for Question 2 in the preceding example, a -100.0 must be specified in the "Variable" data fields of the responses to be omitted. These responses then become bad data points. A bad data point is ignored by the program and written on the output tape as a zero. The re-order program rejects any data inputs with a minus sign as a bad data point. Also, the program tests each input data field against its corresponding variable to insure that the variable's value limit is not exceeded. For example, no data input for Question 2 can have a value greater than eight because Question 2 only has eight data input fields. Any data inputs exceeding the value limits automatically become bad data points and are ignored by the program.

(7) Control Card Response Sequence

The sequence of the variables as written on the output tape and within the control section of the program deck is shown in the Table A15-2, Data Locations and Response Order. All non-chunk responses are grouped in sequential order followed by the chunk responses. Table A15-2 also gives the maximum number of locations per variable and the present response ranges as re-ordered for the Phase II study.

5. Output (NAA02B - NAA02C)

a. A code table printout of new order of responses versus the original order of responses.

b. A re-ordered data tape

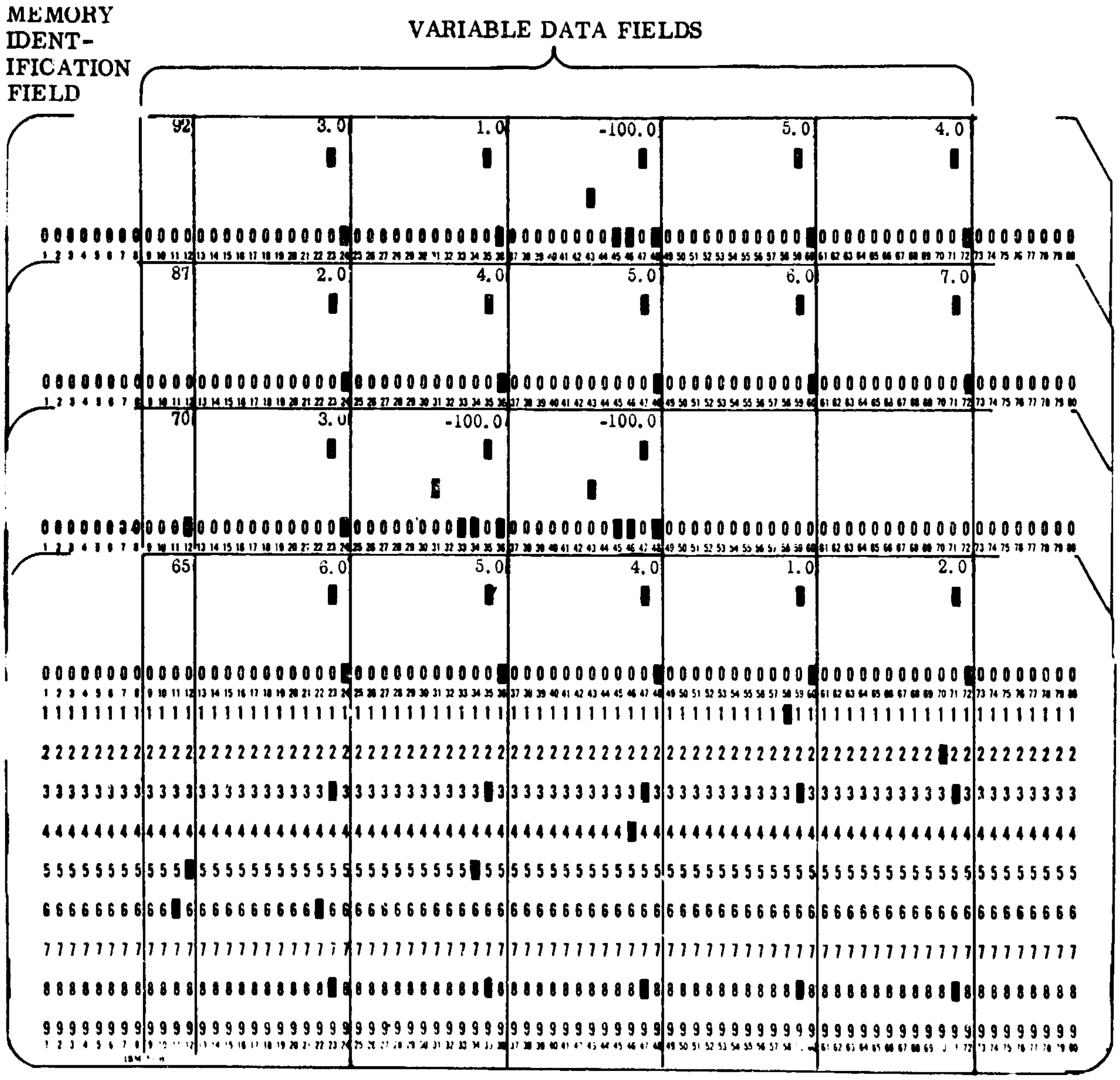
Version I - 1500 re-ordered data tape reduced from 6000 records to 4500 records. The first record of each case is expanded to 119 positions, the second record contains 120 positions and the third record contains 45 positions.

All non-chunk questions except Q-50 are grouped together on the first half of the record No. 1 followed by the five chunk responses on records No. 1 and No. 2. All chunk responses are maintained on this tape to allow for analysis of interchunk relationships. Responses to Q-18 and Q-20 are located on the second record followed by Q-34, MOS, DATE, WK, Q-24, and Q-50 A, Q-50 B, and Q-50 C on record No. 3. Refer to Figure A15-7, 1500 Re-Order Tape Layout.

Version II - 5359 case re-ordered data tape with 5359 records. All non-chunk questions are located on the first half of the tape followed by the five chunk responses. Questions 18, 20, 34, and 50 A, B, and C follow the five chunk responses. MOS DATE and WK are placed at the very end of the tape. Refer to Figure A15-8, 5359 Re-order Tape Layout.

EXAMPLE

VARIABLE DATA CARDS



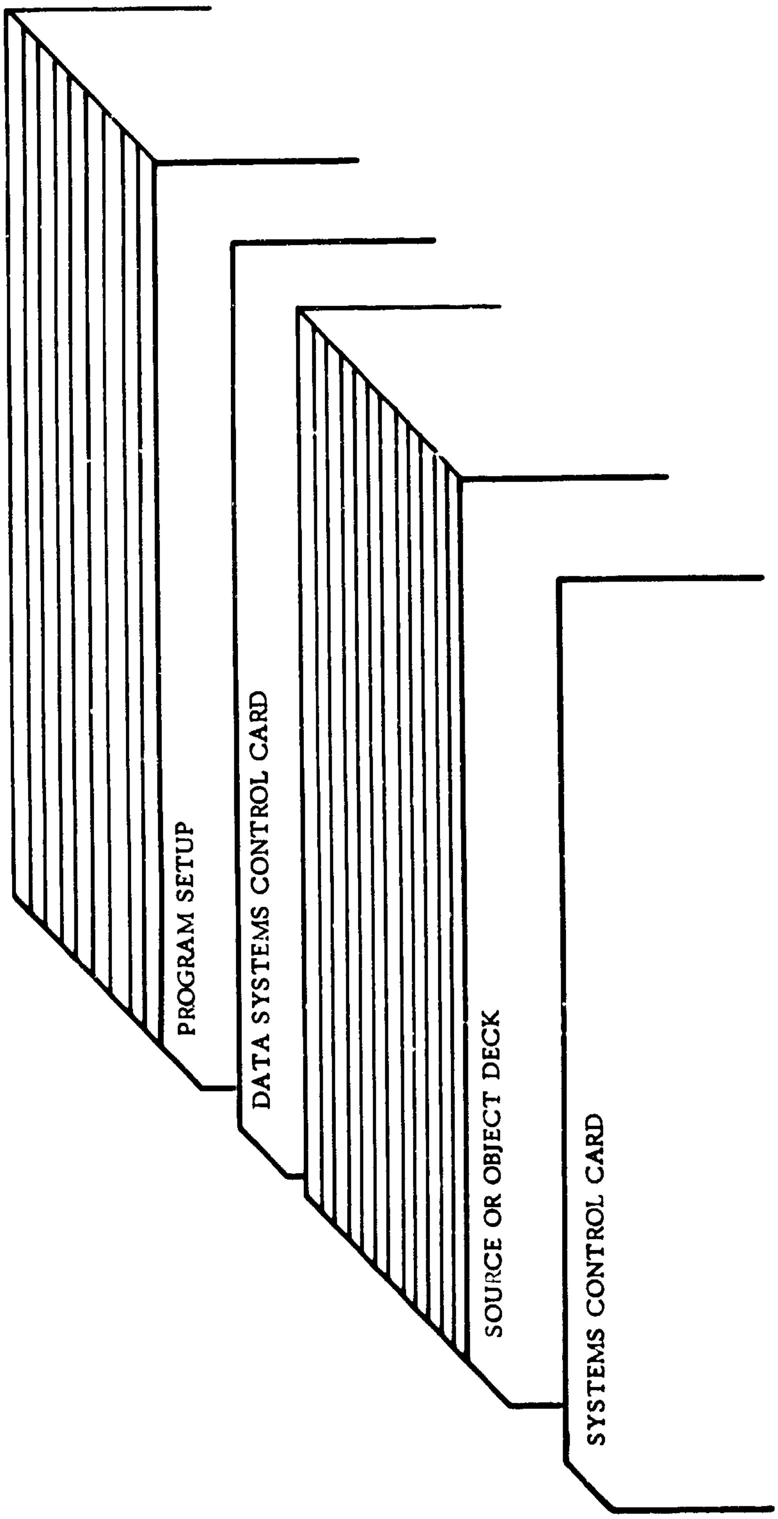


Figure A15-9. Sequence of Cards in Job Decks for the Re-Order and Rescale Programs

Table A15-2. Data Locations and Response Order

Variable Memory Identification Addresses					
Question No. and Sequence	Variable Control Field	First Response Data Field	Maximum Range of Response	Re-order Range of Response	Original and Re-order Comparison
2	2	65	1-8	1-6	Original Order 1, 2, 3, 4, 5, 6, 7, 8 Re-order 6, 5, 4, 1, 2, 3, 0, 0
3	3	73	1-9	1-9	Remains Unchanged
4	4	82	1-5	1-5	Remains Unchanged
5	5	87	1-8	1-7	Original Order 1, 2, 3, 4, 5, 6, 7, 8 Re-order 2, 4, 5, 6, 7, 3, 1, 0
6	6	95	1-6	1-5	Original Order 1, 2, 3, 4, 5, 6 Re-order 5, 4, 3, 2, 1, 0
7	7	101	1-9	1-5	Original Order 1, 2, 3, 4, 5, 6, 7, 8, 9 Re-ordered 1, 2, 4, 5, 3, 3, 3, 0, 0
8	8	110	1-14	1-14	Original Order 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 Re-ordered 2, 14, 5, 6, 4, 10, 11, 3, 9, 12, 7, 13, 8, 0
9	9	124	1-13	1-12	Original Order 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 Re-order 2, 1, 4, 5, 6, 7, 8, 9, 10, 11, 3, 12, 0
10	10	137	1-10	1-9	Original Order 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 Re-order 1, 2, 3, 4, 5, 6, 7, 8, 9, 0
46	11	147	1-3	1-3	Original Order 1, 2, 3 Re-order 1, 2, 3

Table A15-2. (Cont)

Variable Memory Identification Addresses					
Question No. and Sequence	Variable Control Field	First Response Data Field	Maximum Range of Response	Re-order Range of Response	Original and Re-order Comparison
32	12	150	1-2	1-2	Original Order 1, 2 Re-order 2, 1
33	13	152	1-3	1-2	Original Order 1, 2, 3 Re-order 2, 1, 1
35	14	155	1-4	1-4	Original Order 1, 2, 3, 4 Re-order 4, 3, 2, 1
36	15	159	1-6	1-5	Original Order 1, 2, 3, 4, 5, 6 Re-order 5, 4, 2, 3, 1, 0
37	16	165	1-5	1-5	Original Order 1, 2, 3, 4, 5 Re-order 5, 4, 3, 2, 1
38	17	170	1-5	1-5	Original Order 1, 2, 3, 4, 5 Re-order 5, 4, 3, 2, 1
39	18	175	1-6	1-3	Original Order 1, 2, 3, 4, 5, 6 Re-order 3, 2, 1, 2, 2, 0
40	19	181	1-4	1-3	Original Order 1, 2, 3, 4 Re-order 3, 1, 2, 0
41	20	185	1-2	1-2	Original Order 1, 2 Re-order 2, 1

Table A15-2. (Cont)

Variable Memory Identification Addresses					
Question No. and Sequence	Variable Control Field	First Response Data Field	Maximum Range of Response	Re-order Range of Response	Original and Re-order Comparison
42	21	187	1-2	1-2	Original Order 1, 2 Re-order 2, 1
43	22	189	1-4	1-3	Original Order 1, 2, 3, 4 Re-order 1, 2, 3, 0
44	23	193	1-2	1-2	Original Order 1, 2 Re-order 2, 1
45	24	195	1-2	1-2	Original Order 1, 2 Re-order 2, 1
VARIABLES 48, 49, 51, 52, CAN NOT BE RE-ORDERED					
54	29	197	1-6	1-5	Original Order 1, 2, 3, 4, 5, 6 Re-order 4, 3, 5, 2, 1, 0
55	30	203	1-13	1-12	Original Order 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 Re-order 2, 1, 4, 5, 6, 7, 8, 9, 10, 11, 3, 12, 0
56	31	216	1-10	1-9	Original Order 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 Re-order 1, 2, 3, 4, 5, 6, 7, 8, 9, 0
58	32	226	1-13	1-13	Presently not re-ordered
59	33	239	1-3	1-3	Original Order 1, 2, 3 Re-order 3, 2, 1

Table A15-2. (Cont)

Variable Memory Identification Addresses					
Question No. and Sequence	Variable Control Field	First Response Data Field	Maximum Range of Response	Re-order Range of Response	Original and Re-order Comparison
61	34	242	1-4	1-4	Not re-ordered
62	35	246	1-3	1-3	Presently not re-ordered
63	36	249	1-4	1-4	Presently not re-ordered
12	37	253	1-9	1-7	Original Order 1, 2, 3, 4, 5, 6, 7, 8, 9 Re-order 1, 3, 4, 5, 6, 0, 7, 2, 1
13	38	262	1-7	1-6	Original Order 1, 2, 3, 4, 5, 6, 7 Re-order 1, 2, 3, 4, 5, 0, 6
14	39	269	1-19	1-15	Original Order 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 Re-order 1, 7, 5, 2, 6, 9, 10, 8, 3, 10, 12, 14, 14, 11, 11, 0, 15, 13, 4
15	40	288	1-7	1-6	Original Order 1, 2, 3, 4, 5, 6, 7 Re-order 1, 5, 4, 2, 6, 3, 0
17	41	295	1-5	1-5	Original Order 1, 2, 3, 4, 5 Re-order 5, 4, 3, 1, 2
16	42	300	1-15	1-14	Original Order 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 Re-order 2, 14, 5, 6, 4, 10, 11, 3, 9, 12, 7, 13, 8, 0, 1

Table A15-2. (Cont)

Variable Memory Identification Addresses						
Question No. and Sequence	Variable Control Field	First Response Data Field	Maximum Range of Response	Re-order Range of Response	Original and Re-order Comparison	
19	43	315	1-3	1-3	Original Order	1, 2, 3
					Re-order	2, 3, 1
21	44	318	1-5	1-4	Original Order	1, 2, 3, 4, 5
					Re-order	2, 3, 4, 1, 0
22	45	323	1-5	1-4	Original Order	1, 2, 3, 4, 5
					Re-order	2, 3, 4, 1, 0
23	46	328	1-3	1-3	Original Order	1, 2, 3
					Re-order	3, 2, 1
24	47	331	1-3	1-3	Original Order	1, 2, 3
					Re-order	1, 3, 2
25	48	334	1-3	1-3	Original Order	1, 2, 3
					Re-order	1, 3, 2
26	49	337	1-18	1-17	Original Order	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18
					Re-order	7, 6, 5, 4, 15, 16, 11, 10, 9, 17, 3, 14, 2, 1, 0, 12, 13, 8
27	50	355	1-18	1-17	Original Order	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 18
					Re-order	7, 6, 5, 4, 15, 16, 11, 10, 9, 17, 3, 14, 2, 1, 0, 12, 13, 8

Table A15-2. (Cont)

Variable Memory Identification Addresses						
Question No. and Sequence	Variable Control Field	First Response Data Field	Maximum Range of Response	Re-order Range of Response	Original and Re-order Comparison	
28	51	373	1-14	1-14	Original Order	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
					Re-order	2, 14, 5, 6, 4, 10, 11, 3, 9, 12, 7, 13, 8, 0
29	52	387	1-10	1-9	Original Order	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
					Re-order	1, 2, 3, 4, 5, 6, 7, 8, 9, 0
30	53	397	1-4	1-4	Original Order	1, 2, 3, 4
					Re-order	4, 3, 2, 1
31	54	401	1-7	1-6	Original Order	1, 2, 3, 4, 5, 6, 7
					Re-order	6, 5, 4, 3, 2, 1, 0
Q18A B C	55 56 57	408	1-28	1-27	Original Order	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28
					Re-order	17, 18, 19, 9, 11, 5, 4, 3, 2, 20, 8, 21, 22, 16, 5, 25, 23, 24, 27, 10, 26, 1, 12, 7, 6, 13, 14, 0
Q20A B C	58 59 60	436	1-28	1-27	Original Order	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28
					Re-order	17, 18, 19, 9, 11, 15, 4, 3, 2, 20, 8, 21, 22, 16, 5, 25, 23, 24, 27, 10, 26, 1, 12, 7, 6, 13, 14, 0

Table A15-2. (Cont)

Variable Memory Identification Addresses

Question No. and Sequence	Variable Control Field	First Response Data Field	Maximum Range of Response	Re-order Range of Response	Original and Re-order Comparison	
Q34	61	464	1-10	1-10	Original Order	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
					Re-order	6, 7, 2, 3, 4, 9, 5, 8, 10, 1
Q50A	62	474	1-6	1-6	Original Order	1, 2, 3, 4, 5, 6
					Re-order	2, 3, 4, 5, 6, 1
Q50B	63	0				Not re-orderable
Q50C	64	480	1-15	1-14	Original Order	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
					Re-order	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 0

6. Program Execution Time

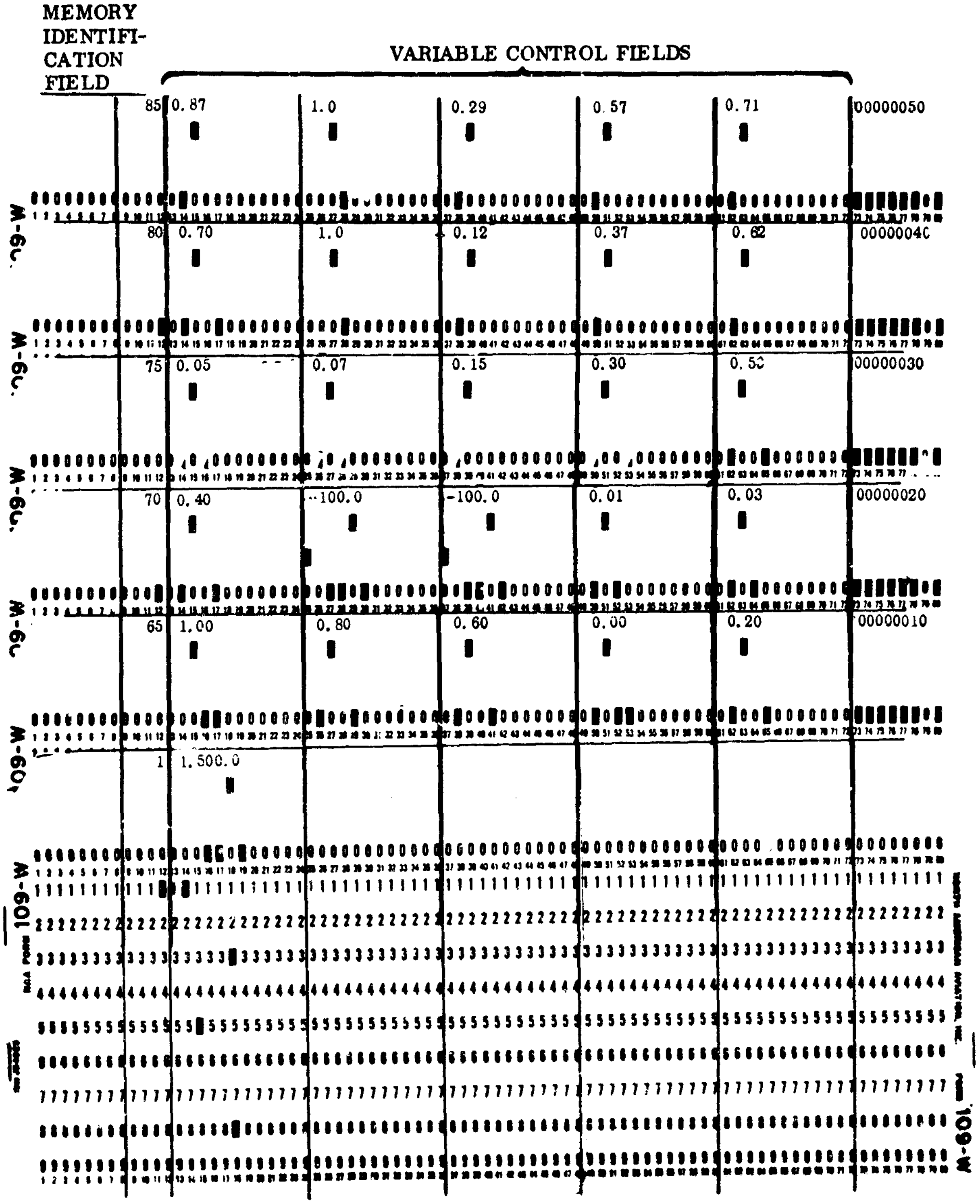
   a. 1500 re-ordered tape creation time = 4 minutes

   b. 5359 re-ordered tape creation time = 12 minutes

D. Additional Processing Performed before Reordering:

Special reordering or "stacking" was performed upon the data of questions 10, 29, 40, 46, 50C, and 56. This stacking was performed with a special subroutine which preceded the normal reorder program. Following are the original and reordered values for these questions.

Question Number		
10, 29, 56	Original Order	01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34
	Stacked Order	04, 07, 06, 06, 05, 05, 05, 05, 07, 06, 03, 04, 03, 06, 09, 02, 06, 03, 04, 07, 07, 06, 01, 03, 07, 01, 07, 01, 03, 08, 03, 01, 03, bb
40	Original Order	01 - 28, 29, 30 - 31, 32
	Stacked Order	01 - 01, 02, 03 - 03, bb
46	Original Order	1, 2, 3, 4, 5, 6, 7, 8, 9
	Stacked Order	1, 1, 1, 2, 2, 2, 3, 3, 3
50C	Original Order	00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46
	Stacked Order	01, 02, 03, 11, 14, 13, 02, 05, 09, 08, 06, 10, 05, 07, 12, 06, 13, 02, 13, bb, 09, 07, 12, 12, 05, 07, 06, 04, bb, bb, 09, 03, 13, 12, 04, 03, 12, 03, 03, 03, 02, 02, 02, 02, 02, 02, 02



Example A. Rescale Data Input

C. Rescale Program (NAA03B - NAA03C)

1. General Description

The rescale program is designed to assign scale values between +9.9999 and -9.9999 to the variable responses. The output tapes are written in the binary mode and each variable is provided with an index address for subsequent input to the BMD09S Transgeneration program. Two versions of the program are necessary to rescale the two basic sets of data: (NAA03B) 1500 Rescale program and (NAA03C) 5359 Rescale program. The rescale values used for Phase II study will be found in Appendix C.

2. Input to Programs NAA03B and NAA03C

The program input operations for the Re-order and Rescale programs are basically the same, and the layout for the program setup cards is identical. Input tapes are the original data tapes originated from the NAA01 programs. The rescale program uses a total of 495 machine memory locations: 1) to identify the number of cases to be rescaled; 2) to identify the variables which are not to be rescaled; and 3) to indicate the rescale values for those variables being rescaled.

(a) "Variable" Control Cards

The memory identification numbers for the "variable" control fields and for the "variable" data fields remain the same as for those in the re-order program. The program setup card description and requirements are shown in "Program Input Operations" under Section IIB4, above. The variables which are not to be rescaled must be so indicated on the "Variable" control cards and the rescale values of the variable responses must be entered on the "Variable" data cards.

(b) "Variable Rescale Data Cards

The data fields assigned to each variable or question represent the original order of the responses for that question. Each response's scale value must be entered into its corresponding original response field in the same way that the reordered responses were entered. The main difference is that scale data inputs replace the re-order response sequence in the "variable" data fields. See Example A for typical sample of data input. See Figure A15-6 for order of cards in job deck.

(c) Bad Data Points

It it is desired to eliminate any original responses from the rescaled data tape, a -100.0 must be specified in the "Variable" data fields of the responses to be omitted. These responses then become bad data points which are ignored by the program.

(d) Variable Indices on the Binary Output Tape

The sequence arrangement of the rescaled variables on the binary output tapes for the 1500 Rescale program (NAA03B) and the 5359 Rescale program (NAA03C) are identical. Table A15-3 shows the Rescale program binary output tape sequence of variables with their accompanying indices. These variable indices must be used for the Transgeneration equations.

Output for Rescale Program (NAA03)

(1) Both versions of the rescale program create binary data tapes as input for the Transgeneration program (BMD09S).

(2) For convenience in checking for input/output accuracy, a check table of the variable scales as written on the binary tape is included with the output tape.

Program Execution Time

(1) 1500 rescaled tape creation time = 4 minutes

(2) 5359 rescaled tape creation time = 12 minutes

Table A15-3. Variable Indices For Rescaled Binary Tapes (1500 and 5359)

Question Number	Variable Indices for Transgeneration Program	Question Number	Variable Indices for Transgeneration Program
I ID	1	Q12	37
INR	2	Q13	38
INTERVIEW TIME	3	Q14	39
MOS	4	Q15	40
DATE	5	Q17	41
WEEK NO.	6	Q16	42
Q2	7	Q19	43
Q3	8	Q21	44
Q4	9	Q22	45
Q5	10	Q23	46
Q6	11	Q24	47
Q7	12	Q25	48
Q8	13	Q26	49
Q9	14	Q27	50
Q10	15	Q28	51
Q46	16	Q29	52
Q32	17	Q30	53
Q33	18	Q31	54
Q35	19		
Q36	20		
Q37	21		
Q38	22		
Q39	23	Q18A	55
Q40	24	Q18B	56
Q41	25	Q18C	57
Q42	26	Q20A	58
Q43	27	Q20B	59
Q44	28	Q20C	60
Q45	29		
Q48	30		
Q49	31		
Q51	32		
Q52	33	Q34	61
Q54	34		
Q55	35		
Q56	36		
Q58	37		
Q59	38	Q50A	62
Q61	39	Q50B	63
Q62	40	Q50C	64
Q63	41		

III. BIOMEDICAL COMPUTER PROGRAMS

Three Biomedical Computer Programs were modified for use in the analysis of the data:

- BMD08D - Cross-Tabulation with Variable Stacking (for compilation of frequency distributions).
- BMD02R - Stepwise Regression.
- BMD09S - Transgeneration.

These programs are documented in Reference 5. For the reader's convenience, the appropriate modification of their documentation appears below.

A. Preparation of Standard Data Input

The form of Standard Data Input is given below:

Cases	Variables				
	x_1	x_2	x_3	. . .	x_p
1	x_{11}	x_{12}	x_{13}	. . .	x_{1p}
2	x_{21}	x_{22}	x_{23}	. . .	x_{2p}
3	x_{31}	x_{32}	x_{33}	. . .	x_{3p}
.	.	.	.		.
.	.	.	.		.
.	.	.	.		.
n	x_{n1}	x_{n2}	x_{n3}	. . .	x_{np}

The headings x_1, x_2, . . . , x_p represent variables, e.g., age, years of experience, number of people supervised, etc. Each row in the table represents a set of corresponding values of these variables, e.g., the age, years of experience, number of people supervised, etc., of a given individual. The entries x_{ij} in the table are called data values, the whole array of these numeric values is called the data matrix, each row of the data matrix is called a case, and each column is called a variable.

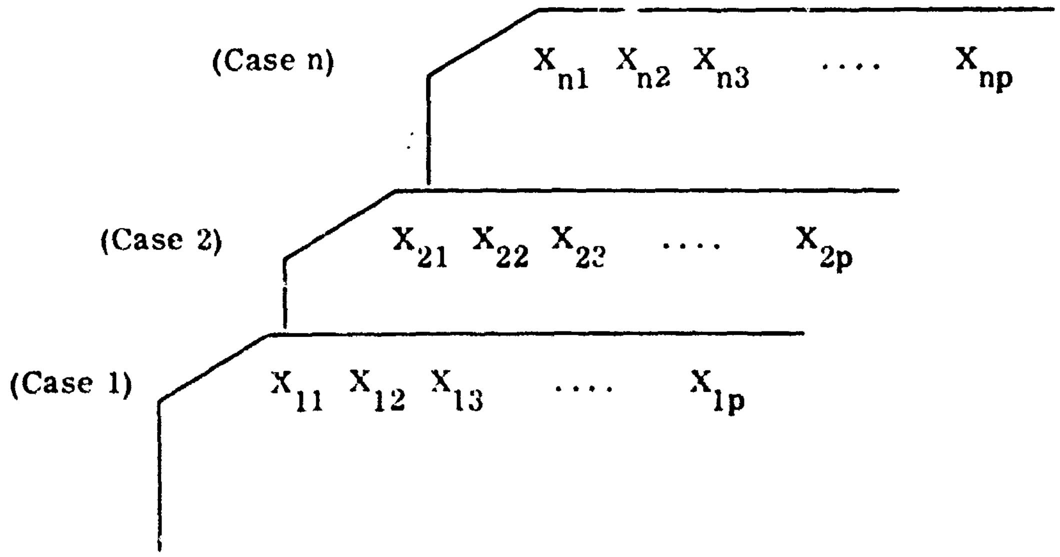
The Standard Data Input is keypunched case-wise. That is, all the data values of the first case are keypunched in order on one or more cards. Then starting on a new card the second case in punched, etc. Examples of cases which require one and two cards, respectively, are shown on page

In general, not all of the fields on a card will be considered as part of the data matrix. For example, identification fields such as the patient number are seldom included. The desired fields are selected by means of the Variable Format Card specification.

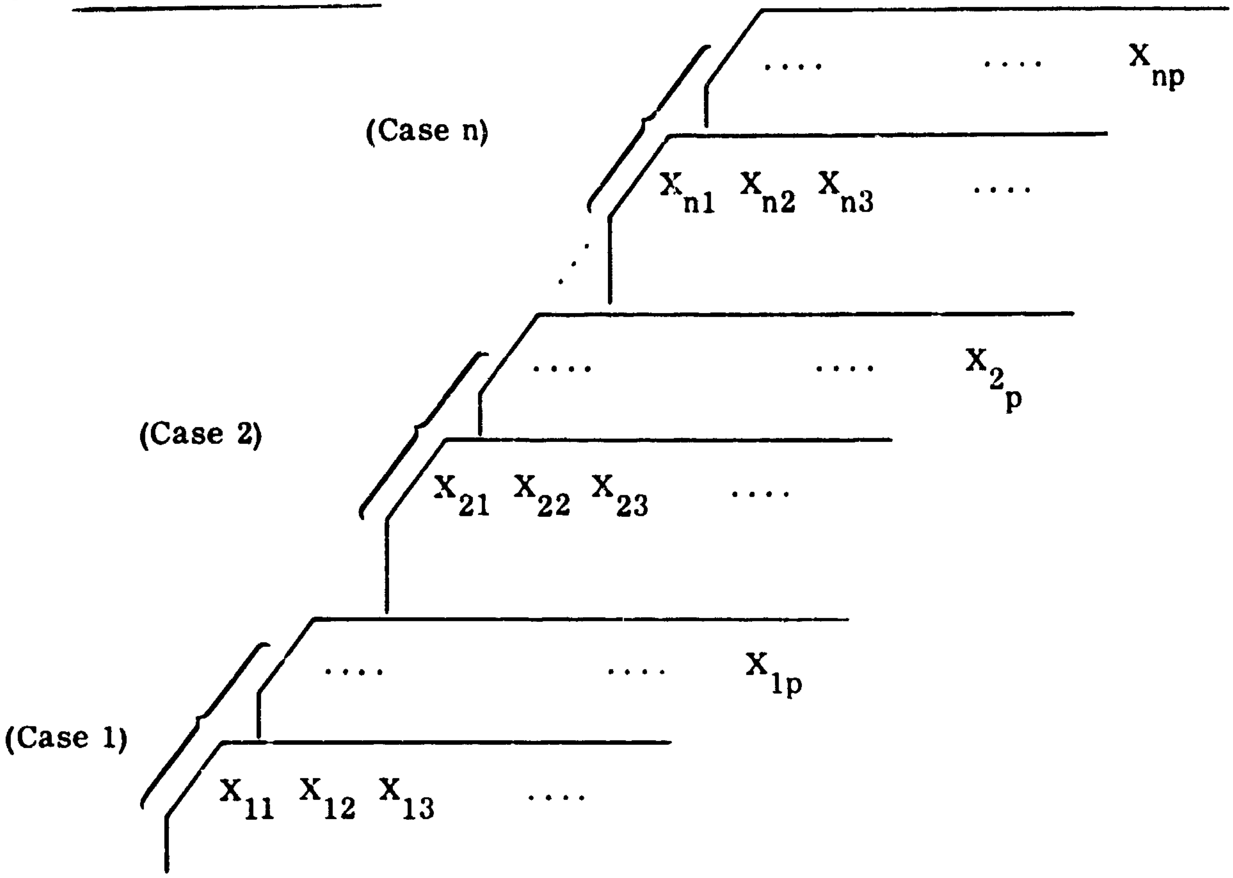
1. Tape Input

All BMD programs have provision for input of data prepared on tape by means of an Alternate Input Tape. Use of tapes for data provides a very compact storage of data files. The tape for one data file may be reread several times to allow several analyses from the same data file by rewinding the Alternate Input Tape.

2. One Card Per Case



3. Two Cards Per Case



4. Preparation of Program Control Cards

The BMD programs are written in a general form so that a wide variety of problems combined with optional computations may be handled by each program. The user specifies certain parameter values, optional computations and optional output, the form of the data input, etc., on Program Control Cards. Standard program control cards which are used in many programs are described in this section. Instructions for the preparation of other control cards specifically required for an individual program appear in the program description.

Unless otherwise stated, each numeric field of a control card should be punched without a decimal point. The decimal point is assumed to be at the extreme right of the field, and blank columns will be interpreted as zeros. Thus, for example, a field including Columns 1-6 (1 through 6) which contains only a 1 in Column 5 will be interpreted to mean 10. In general, on control cards numbers should be punched in the rightmost columns of the field. This is called right-justification.

5. Label Cards

Label Cards allow the user to substitute alphanumeric names for the usual numeric indices (variable numbers or category designations) which appear on the printed output.

Card Preparation

Col. 1-6	LABELS	(Mandatory)
Col. 7-10	The number of the variable (or category, or index) to be named. This number must be right-justified.	
Col. 11-16	The corresponding alphanumeric name. This field is left-justified.	
Col. 17-20	The number of another variable	
Col. 21-26	The corresponding alphanumeric name	
.		
.		
.		
Col. 67-70	The number of another variable	
Col. 71-76	The corresponding alphanumeric name of that variable (up to 7 per card)	

There may be from one to seven pairs of variable numbers and labels on each Label Card. If desired, only one pair may be specified on each card. However, the total number of labels appearing on all the Label Cards must equal the number of labels specified on the Problem or Sub-problem Card.

It is not necessary to label all the variables. Those labeled may be listed in any order.

Example: Suppose the number of variables to be labeled as specified on the Problem Card is 9. Then the Label Cards might be punched as:

```
LABELS   10HEIGHT   07WEIGHT   105AGE   003 X 1   0051 VAR59

         0073   X · Y

LABELS   99SEX   0100ANYNAM

LABELS   05STATUS
```

6. Transgeneration Cards

The term transgeneration is used to include transformations of input variables and creation of new variables prior to the normal computations performed by the various programs.

The transformations described below are performed on the values of the variables in each case. In these examples, the symbol x_i will denote the i^{th} variable as well as its value.

Examples:

$\log_{10} X_4$	X_4	$\log_{10} X_4$ replaces X_4
X_5^c	X_1	X_5^c replaces X_1
$X_2 + X_3$	X_2	$X_2 + X_3$ replaces X_2

By successive transformations, more complicated relationships may be obtained. For example:

(i) To replace X_5 by $\sqrt{X_1^2 + X_3^2}$ four transformations are required:

Variables as they are stored at each step

Transformation	X_1	X_2	X_3	X_4	X_5
$X_1^2 \longrightarrow X_1$	X_1^2	X_2	X_3	X_4	X_5
$X_3^2 \longrightarrow X_3$	X_1^2	X_2	X_3^2	X_4	X_5
$X_1 + X_3 \longrightarrow X_5$	X_1^2	X_2	X_3^2	X_4	$X_1^2 + X_3^2$
$\sqrt{X_5} \longrightarrow X_5$	X_1^2	X_2	X_3^2	X_4	$\sqrt{X_1^2 + X_3^2}$

In this example, it can be seen that the original values of X_5 are irrelevant. Actually the variable X_5 may be a dummy variable introduced by the program specifically to provide capacity for creating new variables by transgeneration. Dummy variables may be required for intermediate storage in order to effect some transformations.

(ii) To replace X_1 by $\exp(-1/2\ X_1^2)$ three transformations are required:

Transformation	X_1	X_2	X_3
$X_1^2 \longrightarrow X_1$	X_1^2	X_2	X_3
$-1/2\ X_1 \longrightarrow X_1$	$-1/2\ X_1^2$	X_2	X_3
$\exp(X_1)$ X_1	$\exp(-1/2\ X_1^2)$	X_2	X_3

(iii) To replace X_4 by $X_2 + \log_{10}(X_4 - X_3 + 100)$ four transformations are required:

Transformation	X_1	X_2	X_3	X_4
$X_4 - X_3 \longrightarrow X_4$	X_1	X_2	X_3	$X_4 - X_3$
$X_4 + 100 \longrightarrow X_4$	X_1	X_2	X_3	$(X_4 - X_3 + 100)$
$\log_{10} X_4 \longrightarrow X_4$	X_1	X_2	X_3	$\log_{10}(X_4 - X_3 + 100)$
$X_2 + X_4 \longrightarrow X_4$	X_1	X_2	X_3	$X_2 + \log_{10}(X_4 - X_3 + 100)$

The transformations are performed in the order in which the Transgeneration Cards appear, so that, for example, the two transgenerations $2X_1 \longrightarrow X_1$ followed by $X_1 - 2 \longrightarrow X_1$ will result in $2X_1 - 2$, whereas $X_1 - 2 \longrightarrow X_1$ followed by $2X_1 \longrightarrow X_1$ will result in $2(X_1 - 2)$.

TRANSGENERATION LIST

Notation to be used in the following transgeneration list:

i, j, k are variable indices (need not be different)

c is a constant

$a_1, a_2, a_3, \ldots$ are constants

n is the number of cases, or sample size

The mean $\bar{X}_i = \frac{1}{n} \sum_{j=1}^{n} X_{ji}$

The standard deviation $s_i = \left[\frac{1}{n-1} \sum_{j=1}^{n} (X_{ji} - \bar{X}_i)^2\right]^{1/2}$

Code	Transgeneration	Restriction
01	$\sqrt{X_1} \longrightarrow X_k$	$X_i \geq 0$
02	$\sqrt{X_i} + \sqrt{X_i + 1} \longrightarrow X_k$	$X_i \geq 0$
03	$\log_{10} X_i \geq X_k$	$X_i > 0$

Code	Transgeneration	Restriction
04	$e^{X_i} \rightarrow X_k$	-
05	arcsin $\sqrt{X_i} \rightarrow X_k$	$0 \leq X_i \leq 1$
06	arcsin $\sqrt{X_i/(n+1)}$ + arcsin $\sqrt{(X_1+1)/(n+1)} \rightarrow X_k$	$0 \leq (X_i/n) \leq 1$
07	$1/X_i \rightarrow X_k$	$X_i \neq 0$
08	$X_i + c \rightarrow X_k$	-
09	$X_i c \rightarrow X_k$	-
10	$X_i^c \rightarrow X_k$	$X_i \geq 0$
11	$X_i + X_j \rightarrow X_k$	-
12	$X_i - X_j \quad X_k$	-
13	$X_i X_j \rightarrow X_k$	-
14	$X_i/X_j \rightarrow X_k$	$X_j \neq 0$
15	If $X_i \geq c$, $1 \rightarrow X_k$; otherwise $0 \rightarrow X_k$	-
16	If $X_i \geq X_j$, $1 \rightarrow X_k$; otherwise $0 \rightarrow X_k$	-
17	$\log_e X_i \rightarrow X_k$	$X_i > 0$
18	$X_i - \overline{X}_i \rightarrow X_k$	-
19	$X_i/s_i \rightarrow X_k$	-
20	$\sin X_i \rightarrow X_k$	-
21	$\cos X_i \rightarrow X_k$	-

Code	Transgeneration	Restriction
22	arctan $X_i \rightarrow X_k$	-
23	$X_i^{X_j} \rightarrow X_k$	$X_i > 0$
24	$c^{X_i} \rightarrow X_k$	$c > 0$
25-39	Not defined	
40	If $X_i = a_1$ or a_2 or $a_3 \ldots, a_7$, then $c \rightarrow X_k$; otherwise X_k remains unchanged.	
41	If X_i is blank, then $c \rightarrow X_k$; otherwise X_k remains unchanged. *Note that in reading numeric fields, a blank field and -0 are equivalent.	$(X_i \neq -0)$*
42	If $X_i = a_1$ or a_2 or $a_3 \ldots, a_7$, then $X_j \rightarrow X_k$; otherwise X_k remains unchanged.	
43	If X_i is blank, then $X_j \rightarrow X_k$;	$(X_i \neq -0)$

When a violation of a restriction in the right-hand column occurs during transgeneration, the program will print a diagnostic message. Most programs will proceed to the next problem, if any. Some programs will delete the case where the violation occurred and continue the computation. Other programs will screen all the input data for additional restriction violations before proceeding to the next problem, if any.

7. Standard Transgeneration Cards

Standard Transgeneration Cards are used with programs which use Standard Data Input. Let p denote the number of variables in the data matrix and m the maximum number of variables allowed by the program for any problem. Any of the variables $x_1, \ldots,$ x_m may be used in transgeneration. The initial values of the first p variables are read from the input data file (Data Cards or Alternate Input Tape). The initial values of the remaining m-p variables are left over from previous calculations. After transgeneration of a particular case, the values of the <u>first</u> p+q variables for that card are used as the values of the transgenerated variables. If the p+q variables required for the computation are not the <u>first</u> p+Q, they must be relocated. This

may be done by using transgeneration code number 25. The numbers p and q (q may be positive, negative, or zero) are specified on the Problem Card. The indices i, j, and k from the transgeneration list may exceed p or p+q but must never exceed m.

Card Preparation

Col. 1-6	TRNGEN	(Mandatory)
Col. 7-9	Variable index k	
Col. 10, 11	Code from transgeneration list (restricted by availability in particular program)	
Col. 12-14	Variable index i	
Col. 15-20	Variable index jor constant c	
Col. 21-25	Blank	
Col. 26	Number of a_i's for transformation 40 or 42	
Col. 27-32	a_1 value	
Col. 33-38	a_2 value	
. . .		
Col. 63-68	a_7 value	

8. Variable Format Cards (for Input)

If the formats for the programs were fixed in advance, all data would have to be punched on cards in the same way for every study. Since this is not usually convenient, the BIMED programs are written so that the user may vary the formats according to his preference for a particular study. For this reason, they are referred to as "variable formats." The program is informed of the format which is to be used by Variable Format Cards. The user must specify on the Problem Card the number of cards used to keypunch the variable format.

In addition to providing an economical method of preparing data input cards (by defining fields to be as small as possible, or "packing" the data), the variable format permits considerable freedom in controlling data input. For instance:

- It allows the user to select for each case only those cards which have fields of interest.
- It allows the user to select only those fields of interest from among the fields of each card.
- It allows the user to scale the data input, i.e., shift the decimal point.

A complete description of formats can be found in FORTRAN programming manuals such as those available from IBM representatives. The features commonly required for the BMD programs are described below.

a. F-type Variable Format

The F-type format is the most frequently used in the BMD programs and is used in BMD 02R (regression) and BMD 09S (transgeneration). It is required when the decimal point is keypunched on the card or when the decimal point is to be placed by the program. All data input values must be signed (±) or unsigned numbers with or without a decimal point punched.

b. I-type Variable Format

This format is required for programs designed to process only integer values, such as BMD08D (Two-way Frequency Distributions). The specification is "nIw," where w is the width of the field (includes sign if punched), and n is the number of fields (assumed to be 1 if not punched). All data must be signed (±) or unsigned integers with no decimal point punched.

9. Finish Card

This card will notify the program that the entire job is finished. The program will complete its computations and will return control to the system monitor.

The preparation of this card is as follows:

Col. 1-6 FINISH

10. Variable Output Formats

All BMD programs use Variable Format Cards to describe the input data; a few require their use to describe output data, that is, data to be printed, punched, or written on tape by the computer. The function of the Variable Format Card is the same for input or for output: it is a description of the data in the medium external to the computer. Input and output formats are identical except for the following minor differences:

a. In F-type formats, the decimal point is always present in the output medium, and a column must be allowed for it.

b. In using the scale factor specification of the form "sPnFw.d," the external representation of the number is 10^8 times the internal number. Thus, if the internal number is -15.9357, a specification of 2PF9.1 would give "bb-1593.6" in the external medium (punched, printed, or tape output).

c. Each "line" of an input format for cards or of an output format for punched cards must not exceed 80 characters in length. Each "line" of an input format for an alternate BCD input tape or of an output

format for printing or for a BCD output tape must not exceed 132 characters in length.

d. Position 1 of the printed line is used to control paper spacing and normally should be left blank (to produce single spacing) by using "1X" as the first specification of the format. (Thus, when printing, only 131 positions are actually available to contain information.) If double spacing is desired, it may be obtained by using "1H0" instead of "1X."

   Note: Care must be taken to allow sufficient width for the maximum size number that may be described by the format specification. (In describing input formats, this is essentially automatic because it is known how many columns of a card are devoted to a particular number.)

11. Preparation of System Cards

In general, system cards inform the system monitor program on the computer of a new job deck and its components and contain information required by the particular installation for its records on computer usage. Since each computing installation uses a slightly different procedure, the system cards are noted with a minimal discussion. There are two or three cards which precede the program deck.

a. Setup card which includes a job identification and information notifying the computer system of estimated and maximum operating time and output page requirements.

b. $IBJ0B card which notifies the system that the program used is in FORTRAN IV, if applicable.

c. $SETUP card which notifies the system on which tape unit the input information is mounted.

12. Program Operation

Jobs submitted to a computing facility which is not familiar with the BMD programs may fail to operate for a number of reasons. A few comments on the program characteristics are given here. Further details are included with tape copies of the computer programs.

13. Computer System and Language

Program development was accomplished on the IBM 7090/94 using the IBM FORTRAN II Monitor System. BMD02R and BMD09S have been converted to the IBM FORTRAN IV Monitor System. Many other systems can accommodate programs written in FORTRAN II or IV.

All programming is written in FORTRAN II or IV with the exception of some subroutines coded in FAP. Substitution of these subroutines will be required for other computers. Use of other monitor systems may also require the replacement of some FAP subroutines.

14. Tape Usage

When the data input consists of sets of p variables on n cases written in consecutive logical records on magnetic tape in binary coded decimal (BCD) form, a special data input tape may be used. The user will specify which tape drive is to receive the special data tape. The logical record will usually be the equivalent of one card. When the program indicates that a binary tape may be used for data input, it is assumed to be in the standard FORTRAN binary tape format.

B. Transgeneration - (BMD09S)

1. General Description

a. General: This program performs selected transgenerations on specified variables in the data. Any of the codes in the previously described Transgeneration List may be selected. Input may be from punched cards, from BCD tape, or from binary tape.

b. Output: For the Phase II study, the rescaled data tapes were used as input to this program. Both are written in Binary with indexed variables. Refer to Tables A-15-11 and A-15-12 Variable Indices on Transgenerated Tape. Output from this program includes:

(1) List of specified transgenerations

(2) Data transgenerated as specified

(3) List of violations of transgeneration restrictions

(4) List of all variables before and after transgeneration for the first and last cases.

Printout specified:

All of the above output items appear on the printout.

Punched card output specified:

Data are transgenerated and punched on cards. All other output items on the above list appear on the printout.

Tape output, BCD or binary specified:

Data are transgenerated and written on tape. The Phase II output tapes are Binary. Table A-15-4 shows the variables and indices presently on the 1500 Transgenerated tape. Table A-15-5 shows the variables and indices presently on the 5359 Transgenerated tape. All other output items on the above list appear on a printout.

Any combination of printout, punched cards, and tape may be specified, except that both BCD and binary may not be specified.

Table A-15-4. Variable Indices on Transgenerated Tape

1500 Trngen Tape, Variables and Indices

Variable	Location	Variable	Location
Q2	(7)		
Q3	(8)		
Q4	(9)	1/2(2 + 7)	(45)
Q5	(10)	(3 x 4)	(46)
Q6	(11)	1/2(5 + 6)	(47)
Q7	(12)	1/2(8 + 9)	(48)
Q8	(13)	/9-55/	(49)
Q9	(14)	/10-56/	(50)
Q10	(15)	*(33 x 35)	(51)
Q46	(16)	1/2 (37 + 39)	(52)
Q32	(17)	1/2 (38 + 44)	(53)
Q33	(18)	*1/2 (40 + 41)	(54)
Q35	(19)	(42 x 43)	(55)
Q36	(20)	(45 x 46)	(56)
Q37	(21)	1/2 (49 + 58)	(57)
Q38	(22)	1/2 (51 + 52)	(58)
Q39	(23)	/56-50C/	(59)
Q40	(24)		
Q41	(25)	F	(60)
Q42	(26)	E	(61)
Q43	(27)	P	(62)
Q44	(28)		
Q45	(29)		
Q48	(30)		
Q49	(31)		
Q51	(32)		
Q52	(33)		
Q54	(34)		
Q55	(35)		
Q56	(36)		
Q58	(37)		
Q59	(38)		
Q61	(39)		
Q62	(40)		
Q63	(41)		
Q50A	(42)		
Q50B	(43)		
Q50C	(44)		

*Variables must be transgenerated in the BMD02R control cards.

Table A-15-5. Variable Indices on Transgenerated Tape

5359 Trngen Tape, Variables and Indices

Variable	Location	Variable	Location
Q2	(7)	Q25	(53)
Q3	(8)	Q26	(54)
Q4	(9)	Q27	(55)
Q5	(10)	Q28	(56)
Q6	(11)	Q29	(57)
Q7	(12)	Q30	(58)
Q8	(13)	Q31	(59)
Q9	(14)		
Q10	(15)	Q18A	(60)
Q46	(16)	Q18B	(61)
Q32	(17)	Q18C	(62)
Q33	(18)		
Q35	(19)	Q20A	(63)
Q36	(20)	Q20B	(64)
Q37	(21)	Q20C	(65)
Q38	(22)		
Q39	(23)	Q50A	(66)
Q40	(24)	Q50B	(67)
Q41	(25)	Q50C	(68)
Q42	(26)		
Q43	(27)	1/2 (2 + 7)	(69)
Q44	(28)	(3 x 4)	(70)
Q45	(29)	1/2 (5 + 6)	(71)
Q48	(30)	1/2 (8 + 9)	(72)
Q49	(31)	/9-55/	(73)
Q51	(32)	/10-56)	(74)
Q52	(33)	(33 x 35)	(75)
Q54	(34)	1/2 (37 + 39)	(76)
Q55	(35)	1/2 (38 + 44)	(77)
Q56	(36)	1/2 (40 + 41)	(78)
Q58	(37)	(42 x 43)	(79)
Q59	(38)	(45 x 46)	(80)
Q61	(39)	1/2 (49 x 38)	(81)
Q62	(40)	1/2 (51 + 52)	(82)
Q63	(41)	**/56-50C/	(83)
Q12	(42)	1/2 (61 + 62)	(84)
Q13	(43)		
Q14	(44)	1/2 (14 + 15)	(85)
Q15	(45)	1/2 (14 + 17)	(86)
Q17	(46)	1/2 (18 + 26)	(87)
Q16	(47)	1/2 (20 + 27)	(88)
Q19	(48)	1/2 (21 + 24)	(89)
Q21	(49)	1/2 (22 25)	(90)
Q22	(50)	E	(91)
Q23	(51)	P	(92)
Q24	(52)	F	(93)
		I	(94)

**Variables must be transgenerated in the BMD02R control cards.

c. Limitations per problem:

(1) n, number of cases ($1 \leq n \leq 130,000$)

(2) p, number of original variables ($1 \leq p \leq 999$)

(3) q, number of variables added after transgeneration ($1 \leq p + q \leq 999$) ($-998 \leq q \leq 998$)

(4) m, number of variables desired for punched card output ($0 \leq m \leq 999$)

(5) t. total number of Transgeneration Cards ($1 \leq t \leq 999$)

(6) s, number of Transgeneration Cards specifying transgeneration code 40 ($0 \leq s \leq 50$)

(7) k, number of Variable Format Cards for input ($1 \leq k \leq 10$)

(8) j, number of Variable Format Cards for printout of output ($0 \leq j \leq 10$)

(9) i, number of Variable Format Cards for punched output ($0 \leq i \leq 10$)

(10) h, number of Variable Format Cards for BCD tape output ($0 \leq h \leq 10$)

d. Running Time:

Estimate of running time and output pages per problem:

Number of seconds $= 20 + \frac{1}{1000}\left(np + \frac{nt}{40} + (n + 10)\,a\right)$ (for IBM 7094)

a = number of transgenerations specifying codes 18 or 19

Number of pages $1 + \frac{i}{50} + \frac{p}{60} + \frac{(\ell + 1)n}{60}$

number of lines of printout in Variable Format Cards for printout

e. Machine Limitation: 32,000 (with systems residence not exceeding 4,000)

f. Program Violation: If a violation of a transgeneration restriction occurs, the transgeneration is not performed for the value which violates the restriction and that value remains unchanged.

g. Number of Variables Specified: The number of variables specified for punched card output may differ from the number specified for printout and for tape.

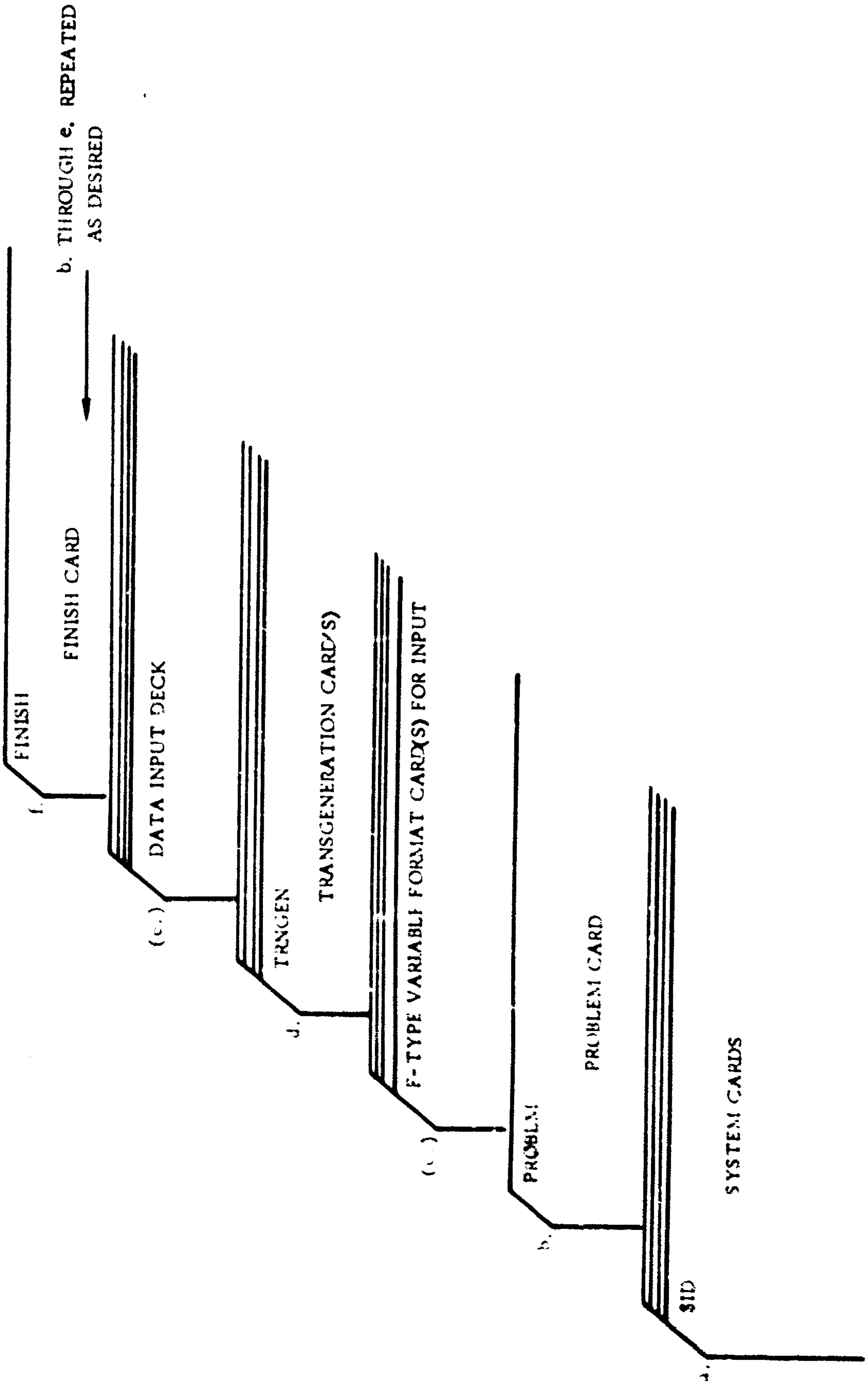


Figure A-15-10. Transgeneration Order of Cards in Job Deck

2. Order of Cards in Job Deck

Cards indicated by letters enclosed in parentheses are optional. All other cards must be included in the order shown.

a. System Cards

b. Problem Card

c. (F-type Variable Format Card(s))

d. Transgeneration Cards

e. (DATA INPUT cards)

(Place data input deck here if data input is from cards.)

. . .

Repeat b. through e. as desired.

. . .

f. Finish Card

3. Card Preparation (Specific for this Program)

Preparation of the Problem Card is specific for this program. All other cards in the preceding section are prepared according to instructions in the Introduction.

a. System Cards

   (1) Setup card for program

   (2) Setup card for tape

   (3) Program deck

   (4) $DATA (for NAA systems)

b. Problem Card (One Problem Card for each problem)

Col. 1-6	PROBLM	(Mandatory)
Col. 7-12	Alphanumeric job number or other identification	
Col. 13-18	n, number of cases ($1 \leq n \leq 130,000$)	
Col. 19-21	p, number of original variables ($1 \leq p \leq 999$)	
Col. 22-25	q, number of variables added after transgeneration ($1 \leq p + q \leq 999$) ($-008 \leq q \leq 998$)	

Col. 26-28	m, number of variables desired for punched card output (if YES in Col. 40-42); otherwise, leave blank ($0 \le m \le 999$)
Col. 29-31	t, total number of Transgeneration Cards ($1 \le t \le 999$) (including those specifying transgeneration code 40)
Col. 32-34	Method of data input: CRD if from punched cards BCD if from BCD tape BIN if from binary tape
Col. 35, 36	Logical tape number of input if input is from tape (may not be 5, 6, or greater than 16); leave blank if input is from punched cards.
Col. 37-39	YES if printed output is desired for all cases; otherwise, leave blank.
Col. 40-42	YES if punched output is desired; otherwise, leave blank.
Col. 43-45	BCD if BCD tape output is desired. BIN if binary tape output is desired; otherwise, blank.
Col. 46, 47	Logical tape number of output if Col. 45-46 are punched (may not be 5, 6, or greater than 16); otherwise, leave blank.
Col. 48-64	Blank
Col. 65, 66	k, number of F-type Variable Format Cards for input if input is from punched cards or BCD tape ($1 \le k \le 10$); if input is from binary tape, leave blank.
Col. 67, 68	j, number of F-type Variable Format Cards for printout if YES in Col. 37-39 ($1 \le j \le 10$); otherwise, leave blank.

Note: Transgeneration codes 18 and 19.

At present this program computes means and standard deviations for transgenerations 18 and 19 only on the original variables. If any other transgenerations are performed on specified variables before transgenerations 18 and 19 are performed, the deviations will not be from the new means but will be from the means of the original variables.

Col. 69, 70	i, number of F-type Variable Format Cards for punched output if YES in Col. 40-42 ($1 \le i \le 10$); otherwise, leave blank.
Col. 71, 72	h, number of F-type Variable Format Cards for BCD tape output if BCD is specified in Col. 43-45 ($1 \le h \le 10$); otherwise, leave blank.

c. (F-type Variable Format Card for Input)

d. Transgeneration Cards

e. (Data Input Deck)

f. FINISH card to indicate end of problem.

C. Cross-Tabulation with Variable Stacking - BMD08D

1. General Description

a. General: The BMD08D program computes two-way frequency tables of data input. Frequency tables are computed from specified ranges of the original variables, variables after transgeneration, stacked variables, or combinations of these. Data input may be positive or negative integers only. The program will not accept data input cards fields which have a punched decimal point.

b. Output

(1) Frequency tables of all combinations of the variables or only those specified by the user.

(2) Percentage distributions of the marginal and total frequencies.

(3) Chi-square values and degrees of freedom for each table.

(4) Means, standard deviations, and correlation coefficients for each pair of variables.

c. Limitations per Problem:

(1) p, number of original variables ($2 \le p \le 60$)

(2) N, number of cases ($2 \le N \le 1500$) ($2 \le N \le 5500$ in special program)

(3) q, number of variables added to the original set after transgeneration or stacking ($-58 \le q \le 58$), ($p + q \le 60$)

(4) (p + q) N, total data input $(4 \leq (p + q) N \leq 19000)$

(5) m, number of Transgeneration Cards $(0 \leq m \leq 99)$

(6) k, number of Variable Format Cards $(1 \leq k \leq 10)$

(7) s, number of Selection Cards $(0 \leq s \leq 99)$

(8) The range of each variable to be cross-tabulated is specified with the following restrictions:

$1 \leq$ Max. X - Min. $X \leq 17$ for N = 5500 cases

$1 \leq$ Max. X - Min. $X \leq 34$ (normal)

$1 \leq$ Max. Y - Min. $Y \leq 60$

where X and Y are the abscissa and ordinate respectively. The program generates a continuous range for each variable from which a frequency matrix is computed on any two variables. Designation of abscissa or ordinate is arbitrary within the above restrictions.

(9) Only those rows and columns which have non-zero entries are printed unless the user indicates on the Problem Card that rows and columns which have zero entries are to be printed.

(10) All values outside the specified range for each variable are listed in the output under the heading, VALUES NOT ENTERED, if the number of such values is less than 50. Otherwise, only the number is printed.

(11) The maximum frequency of each point when cross-tabulated is 999. If any frequency should be greater than 999, it will be set equal to 999. (The 5500 special program allows up to 5500 for a cell frequency.)

(12) Under the IBM FORTRAN II system, the maximum value of each data value is 131,071 for both input and output.

d. Running Time: Estimation of running time and output pages per problem:

Number of seconds (for IBM 7094)

(a) Normal = 30 + 5s
(b) For 5359, 4 records per chunk = 210
(c) For 5359, 1 record per chunk (re-ordered) = 70

Number of pages = 3 + 1 page per frequency table

e. Transgeneration: This program allows transgeneration. Codes 08 to 13, 15, 16, 40, and 41 of the transgeneration list may be used.

2. Order of Cards in Job Deck

Cards indicated by letters enclosed in parentheses are optional. All other cards must be included in the order shown.

a. System Cards

    (1) Setup

    (2) $SETUP

    (3) Program Cards

    (4) * DATA or $DATA

b. Problem Card

c. Range Card(s)

d. (Labels Card(s))

e. I-type Variable Format Card(s)

f. DATA INPUT Cards

    (Place data input deck here if
    data input is from cards.)

g. (Standard Transgeneration Card(s))

h. (Selection Card(s))

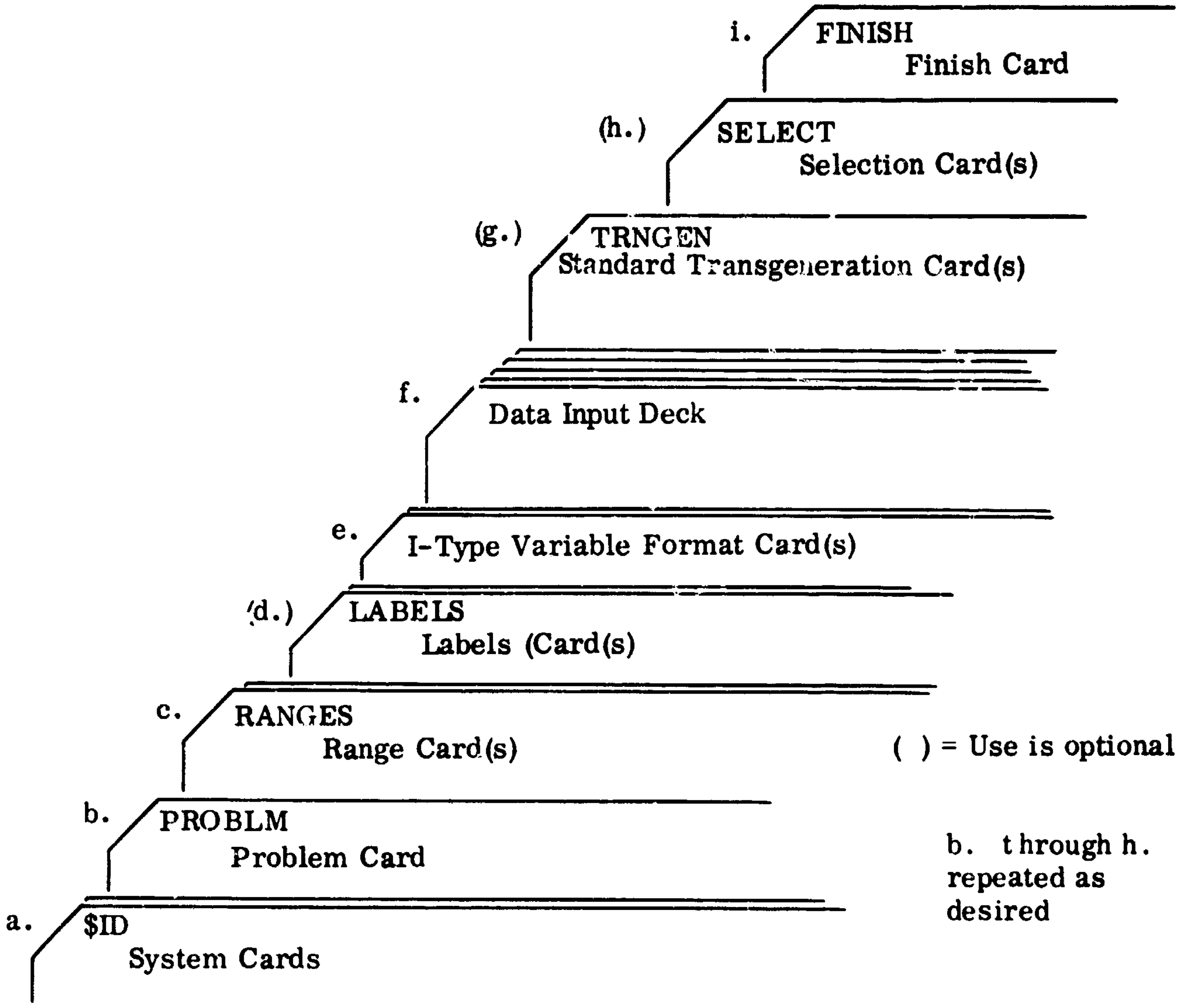
. . .

REPEAT b. THROUGH h. AS DESIRED

. . .

i. Finish Card

Example of Job Deck Set-up:



( ) = Use is optional

b. through h.
repeated as
desired

3. Control Card Description and Preparation (For BMD08D)

a. Systems Cards

1) Setup Card for program

2) Setup Card for tape

3) Program Deck

4) * DATA

b. Problem Card (One Problem Card for each problem)

Col. 1-6	PR0BLM	(Mandatory)
Col. 7-12	Alphanumeric problem code	
Col. 13-15	Number of variables ($2 \le p \le 60$)	
Col. 16-19	Number of cases ($2 \le N \le 1500$)	N = 5359 in special program
Col. 20-22	Number of Selection Cards ($0 \le s \le 99$)	
Col. 23-25	000	No variables added to original set after transgeneration.
	+q	q variables added to original set after transgeneration.
	-q	q variables subtracted from original set after transgeneration.
	Note:	$N(p + q) \le 19,000$, $(p + q) \le 60$ Exactly p + q labels must be keypunched if the Labels Card option is used. Also, the maxima and minima for p + q variables must be specified on the Range Card(s).
Col. 26, 27	01	To enter columns and rows of zero frequency into cross-tabulation table; otherwise, leave blank.
Col. 28-30	z	Number of variables to be labeled ($0 \le z \le 60$). If no variables are labeled, leave blank.
Col. 31, 32	01	To instruct the program to compute and print the $(p + q)(p + q-1)/2$ possible combinations of frequency tables.* (Each variable is cross-tabulated with all other variables.) Otherwise, leave blank. Used for 5359 cases instead of SELECT card.

---

*This option is not recommended when p + q is large. For example, if p + q = 100, the number of output pages required would be 4,950 since $(p + q)(p + q - 1)/2 = 4,950$.

Note: If 01 is keypunched in Columns 31, 32, leave Columns 20-22 blank. Frequency tables are computed in the following order: $(1, 2)$, $(1, 3)$, $\ldots$, $(1, p + q)$, $(2, 3)$, $(2, 4)$, $\ldots$, $(2, p + q)$, $\ldots$, $(p + q - 1, p + q)$, where the first number of the pair is the index of the base variable. When the range of this base variable is greater than 34, the second number of the pair is considered the base variable. If the ranges of both variables are greater than 34, the pair is skipped.

Col. 33-36	Blank	
Col. 67, 68	00	No transgeneration
	m	m Transgeneration Card(s) $(0 \le m \le 99)$
Col. 69, 70	00	Data input from cards
	T	Data input from logical tape T $(T = 6)$
Col. 71, 72	k	k Variable Format Cards $(1 \le k \le 10)$

c. Range Card(s)

Col. 1-6	RANGES	(Mandatory)
Col. 7-12	Maximum value of variable with index 1	
Col. 13-18	Minimum value of variable with index 1	
Col. 18-24	Maximum value of variable with index 2	
Col. 24-30	Minimum value of variable with index 2	
...		
Col. 55-60	Maximum value of variable with index 5	
Col. 61-66	Minimum value of variable with index 5	

If there are more than five variables, continue keypunching a second card, a third card, etc. in the same manner.

Col. 1-6	RANGES	(Mandatory)
Col. 7-12	Maximum value of variable with index 6	
Col. 13-18	Minimum value of variable with index 6	
...		

If variables are generated, their maxima and minima must also be specified on the Range Card(s).

d. Label(s)

e. I-type Variable Format Card(s)

f. Data Input Deck

g. Standard Transgeneration Cards

Col. 1-6	TRNGEN	(Mandatory)
Col. 7-9	Variable index k	
Col. 10, 11	Code from transgeneration list	
Col. 12-14	Variable index i	
Col. 15-20	Variable index j or constant c	
Col. 21-26	Variable index ℓ or number of a_i's for transformation 40	
Col. 27-32	Variable index m or a_1 value	
Col. 33-38	Variable index n or a_2 value	
...		
Col. 63-68	a_7 value	

h. Selection Card(s)

This card has a double purpose:

(1) It indicates the base variable for cross-tabulations, namely the abscissa or the X coordinate.

(2) It indicates the variables to be jointly cross-tabulated, namely the ordinate or the Y coordinate.

The preparation of the Selection Card is as follows:

Col. 1-6	SELECT	(Mandatory)
Col. 7-9	Index of the base variable	
Col. 10, 11	Number of variables to be cross-tabulated with this base variable and whose indices are designated on this card.	
Col. 12-14	Index of the 1st variable to be cross-tabulated.	
Col. 15-17	Index of the 2nd variable to be cross-tabulated.	
...		

Col. 69-71 Index of the 20th variable to be cross-tabulated

Each Selection Card is independent; therefore, if more than 20 variables are to be cross-tabulated, a new Selection Card must be prepared specifying the same base variable, the number of additional variables to be cross-tabulated, and variable indices in the same manner.

i. FINISH card to indicate end of problems.

D. Stepwise Regression - (BMD02R)

1. General Description

a. General:

This program computes a sequence of multiple linear regression equations in a stepwise manner. At each step one variable is added to the regression equation. The variable added is the one which makes the greatest reduction in the error sum of squares. Equivalently it is the variable which has highest partial correlation with the dependent variable partialed on the variables which have already been added; and equivalently it is the variable which, if it were added, would have the highest F value. In addition, variables can be forced into the regression equation and automatically removed when their F values become too low. Regression equations with or without the regression intercept may be selected.

For Phase II project analysis, the 02R program was revised to allow only Binary Tape Input. Both machine run time and operating costs are materially reduced when the data flow into the computer is not slowed by numerical language conversion. Binary tape input proves highly efficient and satisfactory for use in the regression analysis.

Some of the interview guides had some questions which were left blank. If in the set specified to be run in the regression problem any variable is blank, the data of that interview is deleted. A listing is made of the sequential entry number of the deleted interview and a new sample size (n) is computed and shown.

b. Output:

(1) At each step:

(a) Multiple R

(b) Standard error of estimate

(c) Analysis-of-variance table

(d) For variables in the equation:

- Regression coefficient
- Standard error
- F to remove

(e) For variables not in the equation:

- Tolerance
- Partial correlation coefficient
- F to enter

(2) Optional output prior to performing regression:

- (f) Means and standard deviations
- (g) Covariance matrix
- (h) Correlation matrix

(3) Optional output after performing regression:

- (i) List of residuals
- (j) Plots of residuals vs. input variables
- (k) Summary table

c. Limitations per problem:

(1) p, number of original variables ($2 \le p \le 80$)

(2) q, number of variables added by transgeneration ($-9 \le q \le 78$)

(3) p+q, total number of variables ($2 \le p+q \le 80$)

(4) s, number of Sub-problem Cards ($1 \le s \le 99$)

(5) k, number of index cards ($1 \le k \le 4$)

(6) i, number of variables to be plotted ($0 \le i \le 30$)

(7) n, number of cases ($1 \le n \le 9999$)

(8) m, number of Transgeneration Cards ($0 \le m \le 99$)

d. Estimation of running time and output pages per problem:

Number of seconds -

Binary tape Input:

1500 Tape	20 seconds per (s)
5359 Tape	80 seconds per (s)

e. This program allows transgeneration of the variables. Codes 01-17 and 20-24 of the transgeneration list may be used.

2. Order of Cards in Job Deck

Cards indicated by letters enclosed in parentheses are optional. All other cards must be included in the order shown.

a. System Cards

b. Problem Card

c. (Transgeneration Card(s))

d. Vindex Cards (For rescale or transgeneration tape input only)

e. (Labels Card(s))

f. Sub-problem Card(s)

g. Control-Delete Card(s)

h. (Index-Plot Card(s))

i. Finish Card

3. Control Card Description and Preparation (For BMD02R)

a. System Cards

(1) Setup

(2) $SETUP

(3) Program Cards

(4) * DATA or $DATA

b. Problem Card (One Problem Card for each problem)

Col. 1-6 PR0BLM (Mandatory)

Col. 10-15 Alphanumeric problem name (BMD08D)

Col. 17-20 Sample size = 1500 or 5359

Col. 24, 25 Number of original variables = Number of labeled variables ± transgenerated variables.

Col. 29, 30 Number of Transgeneration Cards $(0 \le m \le 99)$

Col. 34, 35 Number of variables added by transgeneration $(-9 \le q \le 78)$

Col. 39, 40 Number of Index Cards

Col. 44, 45 Number of Sub-problem Cards $(1 \le s \le 99)$

Col. 48, 49 Number of variables labeled on Labels Cards.

Col. 51-53 YES If means and standard deviations are to be printed; otherwise, leave blank.

Col. 55-57 YES If covariance matrix is to be printed; otherwise, leave blank.

Col. 59-61 YES If correlation matrix is to be printed; otherwise, leave blank.

Col. 63-65 YES If zero regression intercept is desired; otherwise, leave blank.

Col. 68, 69 NO If tape specified in Columns 39, 40 is not to be rewound before this problem; leave blank if Columns 39, 40 are blank, or if tape rewind is desired.

Col. 70, 72 Number Variables in Binary Record:

a. 1500 Transgeneration Tape = 062

b. 5359 Transgeneration Tape = 094

c. Transgeneration Cards (see section III B, this appendix)

d. Index Card

Col. 1, 6 VINDEX (Mandatory)

Col. 7, 9 Indices of Variables

10, 12 in Regression equation

13, 15 See Table A15-4 for list of variable indices on 1500 Trans-
. generated Tape and Table A15-5 for indices of variables on
. 5359 Transgenerated data tape
64, 66

NOTE: Maximum of 4 Vindex Cards

e. Labels Cards (see section III A 4, this appendix)

f. Sub-problem Card

Col. 1-6	SUBPRØ (Mandatory)
Col. 9, 10	Label Number of the dependent variable
Col. 14, 15	Maximum number of steps. This will be $2(p+q)$ if left blank.
Col. 20-25	F-level for inclusion. This will be 0.01 if left blank.
Col. 30-35	F-level for deletion. This will be 0.005 if left blank.
Col. 40-45	Tolerance level. This will be 0.001 if left blank.
Col. 49, 50	Number of variables on the Index-Plot Card ($0 \leq i \leq 30$)
Col. 53-55	YES If Control-Delete Cards are included.
Col. 58-60	YES If list of residuals is to be printed.
Col. 63-65	YES If summary table is to be printed.

g. Control-Delete Card

Col. 1-6	C0NDEL	(Mandatory)
Col. 7	Control value* for first variable	
Col. 8	Control value* for second variable	
	. . .	
Col. 72	Control value* for 66th variable	

If there are more than 66 variables, continue on another card of the same form, until p+q variables have been specified.

The variable numbers above refer to variables after transgeneration.

*CONTROL VALUES

1	Delete variable (or dependent variable)
2	Free variable
3	Low-level forced variable
	. . .
9	High-level forced variable

If no Control-Delete Cards are included, or if a field is left blank on the Control-Delete Cards included in the deck, the value 2 will be assigned if the variable is not the dependent variable and the value 1 assigned if it is the dependent variable.

h. Index-Plot Card

Variables specified on this card are plotted against the residuals.

Col. 1-6	IDXPLT	(Mandatory)
Col. 7, 8	First variable to be plotted	
Col. 9, 10	Second variable to be plotted	
	. . .	
Col. 65, 66	30th variable to be plotted	

No more than 30 variables may be plotted per sub-problem. Variables specified refer to the original data after transgeneration.

i. Finish Card (see section III A 8, this appendix)

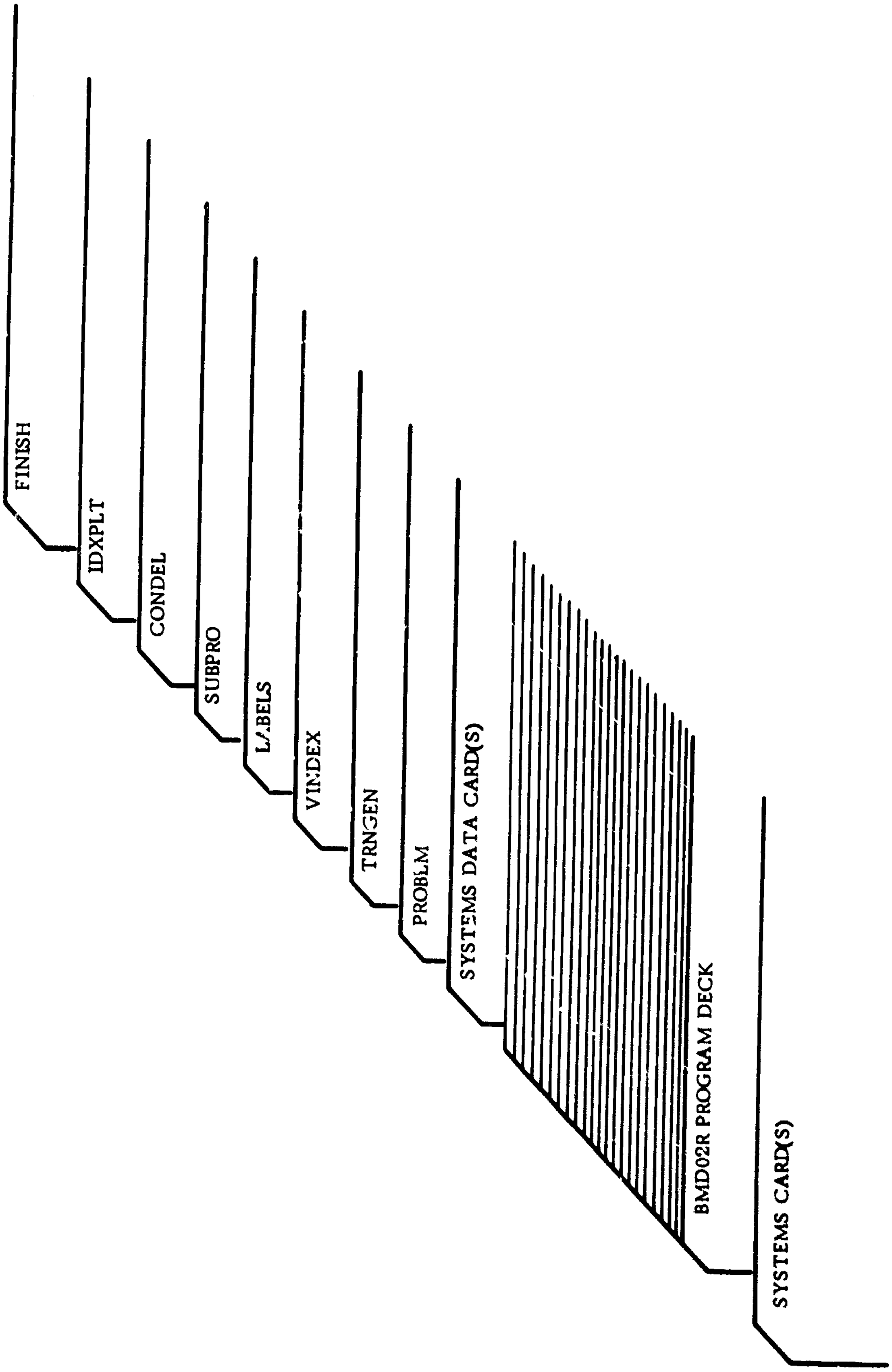


Figure A15-11. Order of Cards in Job Deck (BMD02R)

REFERENCES

Reference 1 contains an extensive bibliography of past user-needs studies, and Reference 2 contains a review of recent ones. Reference 7 is entirely devoted to scientific communication.

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13 ABSTRACT

The Department of Defense (DOD) has conducted a two-phase study to determine how scientists and engineers in government and industrial research, development and production activities acquire information for performing work assignments on DOD programs. The Phase I study covered the information needs of DOD personnel engaged in research, development, test and evaluation (RDT&E) activities.

Phase II of this study investigated the nation's defense industry to determine its information needs, and the flow of scientific and technical information (flow process) inherent in satisfying those needs. It is based on a representative sample of 1500 individuals from approximately 120,000 scientists, engineers and technical personnel in 83 organizations in the defense industry. Sixty-three questions were asked them regarding the user of scientific and technical information, his scientific or technical task, his utilization of information centers and services, and the searc [illegible] quisition process. The analysis included compilation of frequency distributions for answers to questions and pairs of questions. In addition the qualitative data have been transformed into numerical form, and models have been specified for relationships among elements of the flow process. The models are estimated from the data by means of regression analysis, to yield significant relationships and factors within the flow process.

The Phase II Final Report describes the results of Phase II, and compares them with those of Phase I. It is presented in three volumes. Volume I contains a nontechnical summary of Phase II, including guidelines for management decisions and recommendations for the future. Volume II describes the technical approach, findings and recommendations of the study. Volume III presents the reduced data, in the form of frequency distributions and models for relationships among elements of the flow process.

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	ROLE	WT	ROLE	WT	ROLE	WT
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Information Requirements						
Information Centers and Services						
Flow of Scientific and Technical Information (Flow Process)						
Structure and Numerical Description of Flow Process						
Relationships and Factors within Flow Process						
Analysis and Optimization of Flow Process						
Information Storage and Retrieval						
Defense Documentation Center						
Technical Abstract Bulletin						
Scientific and Technical Aerospace Reports						
Engineering Data						
STINFO						
Surveys						
Critical Incident Technique						
Interview Guide						
Defense Industry Population						

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